CHAPTER III
WITHOUT-PROJECT CONDITIONS

One of the most important elements of any water resource evaluation is defining the scope of the problems to be solved and opportunities to be addressed. Significant in this process is defining existing resource conditions and how these conditions may change in the future. The magnitude of change not only influences the scope of the problems and opportunities, but the extent of related resources that could be influenced by possible actions taken to address them. Accordingly, existing conditions and estimated future without-project baseline conditions are briefly assessed below, with a focus on the primary study area of the Los Vaqueros Expansion Investigation (LVE) (shown in **Plate 1**).

EXISTING CONDITIONS

Existing water resources and physical, biological, social and economic, and cultural conditions in the primary study area are described in this section.

Infrastructure, Operations, and Water Resources

The Sacramento-San Joaquin Delta (Delta) is at the center of the California's water resources system. Both the Central Valley Project (CVP) and State Water Project (SWP) have developed infrastructure and institutional mechanisms that rely on the movement of water through the Delta to balance the geographic disparities between water resource supplies and demands. This section describes the existing infrastructure of the CVP, SWP, and other Delta water users, how these facilities operate, the reliability of the supplies provided, and the quality of those supplies.

Existing Infrastructure

The discussion of water facilities located within the primary study area begins with Federal and State water project facilities, followed by a description of local water agency facilities. Water supply facilities that serve the study area are shown in **Figure III-1,** and statewide CVP/SWP facilities are shown in **Plate 2**.

Federal Facilities

The primary Federal project in the study area is the CVP, which received Federal authorization in 1935, and was reauthorized in 1937 as a part of the Rivers and Harbors Act. More than 3 million acres of farmland and nearly 2 million drinking water consumers receive water from the CVP. These distributions are achieved through long-term contracts with over 250 contractors in 29 of the 58 counties in California.

The CVP is organized into nine divisions established in relation to rivers or facilities within the basin: Trinity River, Shasta, American River, West San Joaquin, East Side, Sacramento River, the Delta, Friant, and San Felipe. The Delta and San Felipe divisions have facilities within the primary study area, and are described in greater detail below.

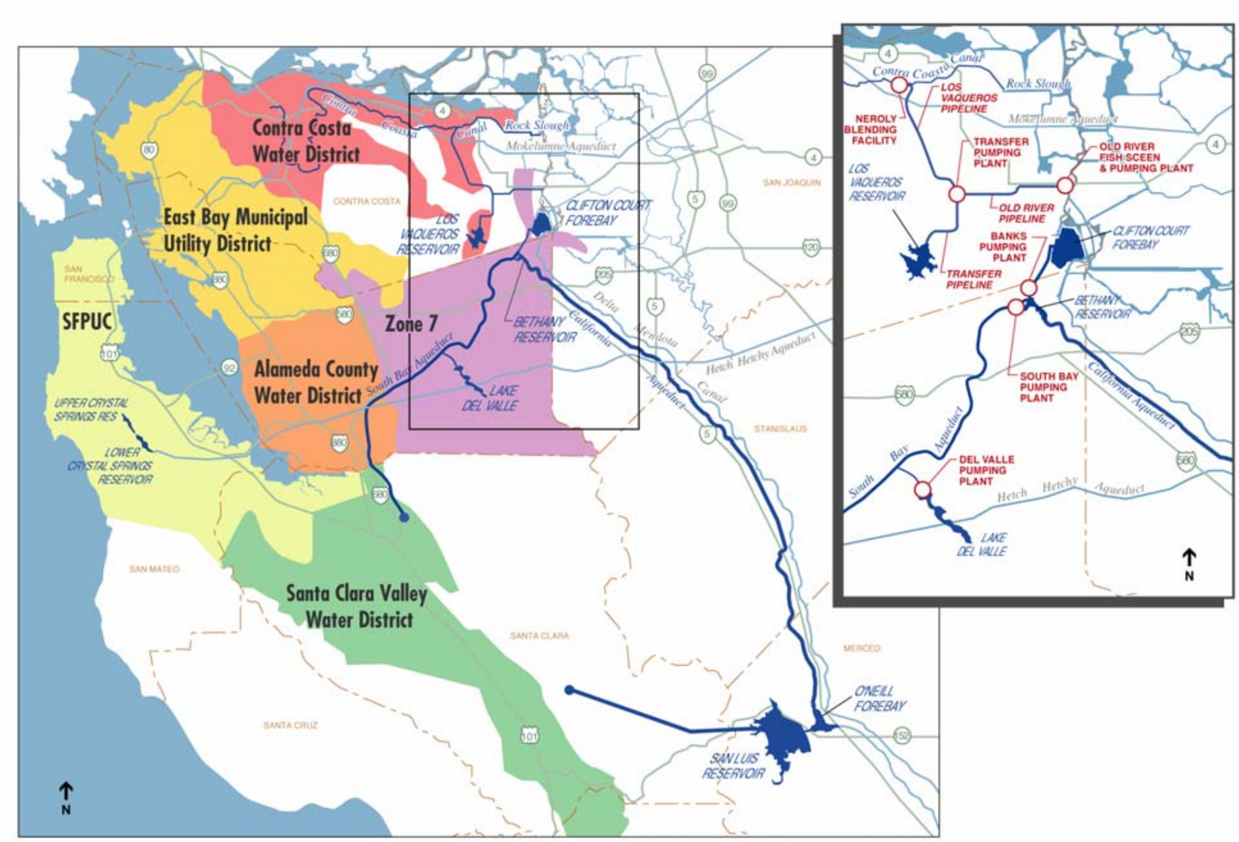


FIGURE III-1 – WATER SUPPLY FACILITIES SERVING THE STUDY AREA

Delta Division – The Delta Division contains facilities the CVP uses to transfer water to various service areas south and west of the Delta. The main features of the Delta Division are the Delta Cross Channel, Tracy Pumping Plant, Tracy Fish Collection Facility, Contra Costa Canal, Contra Loma Dam, and Delta-Mendota Canal.

- **Delta Cross Channel** – The Delta Cross Channel is a controlled diversion structure, used to transport water from the Sacramento River to the Tracy Pumping Plant. Water is drawn from the Sacramento River and delivered to the Mokelumne River to combat saltwater intrusion in the Delta and curb local water pollution. The water then flows through natural channels to the Tracy Pumping Plant, where it is pumped into the Delta-Mendota Canal.

- **Tracy Pumping Plant** – The Tracy Pumping Plant includes an inlet channel, pumping plant, and three discharge pipes. Water in the Delta is lifted 197 feet for delivery to the Delta-Mendota Canal. The plant's six pumps are each capable of pumping 767 cubic feet per second (cfs).

Tracy Pumping Plant

- **Tracy Fish Collection Facility and Fish Louvres –** Fish collection and screening facilities have been implemented to protect fish from the intake at the Tracy Pumping Plant. Collected fish are transported and released elsewhere in the Delta.

- **Contra Costa Canal –** The Contra Costa Canal, owned by Reclamation and operated and maintained by Contra Costa Water District (CCWD), receives water from the Delta through a diversion at Rock Slough near the cities of Brentwood and Oakley. A series of four pumping plants lift the diverted water to a high point in the canal, from which it flows 44.7 miles in a westerly direction through both open channels and pipelines in the cities of Oakley, Antioch, Pittsburgh, and Concord. The canal finally terminates at Martinez Reservoir in the City of Walnut Creek. The canal also receives water from the Los Vaqueros Project, which is mixed with Delta water at the Neroly Blending Facility.

- **Contra Loma Dam and Reservoir –** Contra Loma Reservoir is an offstream storage facility for the Contra Costa Canal, located at the southern end of the City of Antioch. Water is pumped from the Contra Costa Canal into the reservoir for storage, and released by gravity. Contra Loma Reservoir has a capacity of 2,100 acre-feet. The reservoir is owned by Reclamation and operated and maintained by CCWD.

Contra Loma Dam and Reservoir

- **Delta-Mendota Canal –** The Delta-Mendota Canal carries water about 116 miles from the Tracy Pumping Plant intake at Old River, along the west side of the San Joaquin Valley to the Mendota Pool, about 30 miles west of Fresno. The first 95 miles of the 4,600 cfs capacity canal is lined with concrete, and the remaining distance is unlined.

San Felipe Division – The San Felipe Division of the CVP is located in the central coast area of California, and includes portions of Santa Clara, San Benito, and Santa Cruz counties. Facilities in the San Felipe Division transfer water from San Luis Reservoir to agricultural, and municipal and industrial (M&I) users. The primary features of the San Felipe Division are described below:

- **Pacheco Tunnel –** The two reaches of the Pacheco Tunnel, and intermediate Pacheco Pumping Plant, transfer water from San Luis Reservoir through the Diablo Mountain Range. The 9.5-foot-diameter tunnels each have a capacity of 480 cfs and total 7.1 miles in length.

- **Pacheco Conduit –** The Pacheco Conduit is a 7.9-mile-long, 120-inch-diameter pipeline with a capacity of 480 cfs that extends from the Pacheco Tunnel Reach 2 outlet to the bifurcation of the Santa Clara and Hollister conduits.

- **Hollister Conduit** – The Hollister Conduit is a 19.5-mile-long pipeline with a capacity of 83 cfs that connects the Pacheco Conduit to San Justo Reservoir.

- **Santa Clara Tunnel and Conduit –** Santa Clara Tunnel and Conduit have a capacity of 330 cfs and convey water 22.1 miles from the Pacheco Conduit to the Coyote Pumping Plant.

- **San Justo Dam and Reservoir –** San Justo Dam is located about 3 miles southwest of Hollister. The 141-foot-high earthfill dam and a 66-foot-high dike form a reservoir with a capacity of 9,906 acre-feet.

- **Pumping Plants –** The Pacheco Pumping Plant is located at the end of Pacheco Tunnel Reach 1, and the Coyote Pumping Plant is located at the end of the Santa Clara Conduit.

State Facilities

The SWP was approved by California voters in 1960 (California Water Code, Section 12930, et seq.), and is operated by the State Department of Water Resources (DWR). SWP deliveries, of which 70 percent are urban and 30 percent are agricultural, provide water to meet the demands of 20 million people and 600,000 acres of irrigated land. Twenty nine different agencies in California currently hold contracts with the SWP. The northern boundary of the project is Plumas County and the project extends to Riverside County in the south. Completed project facilities include 23 dams and reservoirs, 6 powerplants, 17 pumping plants, and 533 miles of aqueduct.

The main SWP features of water conveyance and storage in the study area are the South Bay Aqueduct (SBA), South Bay Pumping Plant, South Bay Aqueduct Conveyance System, Banks Pumping Plant, Clifton Court Forebay, Bethany Reservoir, Patterson Reservoir, and Del Valle Reservoir and Pumping Plant.

- **South Bay Aqueduct –** The SBA was the first delivery system completed in the State Water Project (1969). It serves three contracting agencies within the study area: Santa Clara Valley Water District (SCVWD), Alameda County Water District (ACWD), and Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7). This system is designed to deliver 210,000 acre-feet per year (AFY) through a series of facilities. Lifting water from Bethany Reservoir to the Altamont Pass and delivering it by gravity through a system of pipelines, canals, and tunnels across the Livermore and Santa Clara valleys, the SBA ends at a terminal storage reservoir east of San Jose.

- **South Bay Pumping Plant –** The existing South Bay Pumping Plant consists of nine pumping units with a combined rated capacity (based on unit nameplate rating) of 330 cfs. This facility lifts water from the Bethany Reservoir for delivery to the SBA.

- **South Bay Aqueduct Conveyance System –** The SBA conveys water from the Delta through 44.7 miles of pipelines, canals, and tunnels (10.8 miles of canal, 32.1 miles of pipeline, and 1.8 miles of tunnel).

  Brushy Creek Pipeline – The 5-mile-long Brushy Creek Pipelines connect the Surge Tanks and Dyer Canal.

  Dyer, Livermore, and Alameda Canals – Dyer Canal is the initial open-channel, gravity portion of the SBA and conveys water 1.93 miles to the Altamont Pipeline. The 1.96 miles of Livermore Canal carry water from the Altamont Pipeline to the Patterson Reservoir. The

Alameda Canal begins at the control structure downstream from Patterson Reservoir and continues for approximately 6.86 miles to the Del Valle Pipeline.

Altamont Pipeline – The Altamont Pipeline runs from Dyer Canal to Livermore Canal.

Del Valle and Santa Clara Pipelines – Del Valle Pipeline connects Alameda Canal to the Santa Clara Pipeline. Santa Clara Pipeline, the final conveyance facility of the SBA, carries water from Del Valle Pipeline to be stored in the Santa Clara Terminal Reservoir.

- **Clifton Court Forebay –** Clifton Court Forebay, the head of the California Aqueduct, is located on the southwest end of the Delta, about 10 miles northwest of the City of Tracy. With a storage capacity of 31,000 acre-feet, the forebay provides regulation and off-peak storage of water pumped at Banks Pumping Plant.

- **Harvey O. Banks Pumping Plant –** Banks Pumping Plant, located near Byron, about 8 miles northwest of Tracy, lifts water 244 feet from the Delta into Bethany Reservoir. Although the facility's 11 pumps have a total physical capacity of 10,300 cfs, pumping at Banks is limited to 6,680 cfs (average daily) by diversion limitations at Clifton Court Forebay.

- **Skinner Fish Collection Facility –** The Skinner Fish Collection Facility has been implemented to salvage fish from the intake at Banks Pumping Plant, reducing mortality at the facility. Fish are collected and transported for release elsewhere in the Delta.

Harvey O. Banks Pumping Plant

- **Bethany Reservoir –** Water is pumped from the Delta into Bethany Reservoir and is either released into the California Aqueduct or pumped by the South Bay Pumping Plant into the SBA.

- **Patterson Reservoir –** Patterson Reservoir, located near Livermore, has 100 acre-feet of storage capacity and serves the adjacent Patterson Pass Water Treatment Plant (WTP).

- **Del Valle Reservoir –** Del Valle Reservoir was constructed to provide regulatory storage for the SBA, flood control for Alameda Creek, and recreation benefits. This 235-foot-high dam provides 77,100 acre-feet of total storage for SWP water and local runoff.

- **Del Valle Pumping Plant –** Del Valle Pumping Plant, located at the base of the dam, has four variable speed pumps with a total pumping capacity of 120 cfs. Water is carried from the SBA to the pumping plant where it is lifted into Del Valle Reservoir.

- **Santa Clara Terminal Reservoir –** Santa Clara Terminal Reservoir is a 9 acre-foot steel holding tank located at the terminus of the SBA, the water source for the Penitencia WTP.

Local Water Agency Facilities

This section describes local water agencies located in or near the primary study area. Following are brief descriptions of each agency; agency conveyance, storage, and treatment facilities are summarized in **Tables III-1** through **III-3**, respectively. Local water agency boundaries are illustrated in **Figure III-1** and in **Plate 4**.

Contra Costa Water District – CCWD, formed in 1936, services urban and agricultural customers throughout north, central and east Contra Costa County. Approximately 30 percent of its water is used by major industrial customers, less than 2 percent for large area irrigation, 33 percent is used by five municipal customers (Antioch, Pittsburg, Martinez, Southern California Water Company serving Bay Point, and Diablo Water District serving Oakley), and the remainder is treated and served to CCWD's customers in Concord, Clayton, Pleasant Hill and Walnut Creek. CCWD also diverts water for East Contra Costa Irrigation District, treating and conveying it to the City of Brentwood for distribution to the city's customers. CCWD water supply facilities include two water treatment plants (one owned jointly with Diablo Water District), the Contra Costa Canal, Contra Loma and Martinez reservoirs (owned by Reclamation and operated by CCWD), Mallard Reservoir, the 22-mile Multi-Purpose Pipeline, the Los Vaqueros Project (described later), and a treated water distribution system (including over 800 miles of pipelines and associated reservoirs and pump stations).


Contra Costa Canal

Santa Clara Valley Water District – Formed in 1929, SCVWD serves all of Santa Clara County, a total of 1,300 square miles and 1.7 million residents. SCVWD water supply facilities include three water treatment plants, a local groundwater basin, 10 local reservoirs, and a raw water conveyance system.

Alameda County Water District – ACWD was established in 1914 and serves about 318,000 customers (primarily urban) in a 101-square-mile area. Located about 20 miles southeast of San Francisco, ACWD encompasses the cities of Newark and Fremont, and Union City. ACWD water supply facilities include a conveyance and distribution system, two wellfields in the Niles Cone groundwater basin, direct connections to the San Francisco Public Utilities Commission (SFPUC) Bay Division pipeline, a blending facility, two raw water treatment plants, and one desalination facility.

Zone 7– Zone 7 was established in 1957 as one of 10 active zones in the Alameda County Flood Control and Water Conservation District. Zone 7 serves almost 200,000 customers in a 425-square-mile area encompassing the Livermore-Amador Valley, Sunol Valley, and portions of the Diablo Range. Zone 7's water supply facilities include two existing WTPs and the Livermore-Amador Valley groundwater basin.

TABLE III-1
LOCAL CONVEYANCE AND PUMPING FACILITIES IN THE STUDY AREA

Facility	Type	Size/Capacity	Supply	Use
Contra Costa Water District (CCWD)				
Rock Slough Intake & Pump Station[1]	Pump Station	350 cfs	Rock Slough	Primary supply for Contra Costa Canal
Contra Costa Canal[1]	Canal	350 cfs	CCWD Delta Intakes	Distribution to CCWD & customers
Old River Intake & Pump Station	Pump Station	250 cfs	Old River	Supplies Los Vaqueros Reservoir & Contra Costa Canal
Old River Pipeline	78" Pipeline	320 cfs 34,500 feet	Old River PP to Transfer Facility	Supplies Los Vaqueros Reservoir
Los Vaqueros Transfer Facility	Pumping Plant & Reservoir	200 cfs 4 MG	Old River Pipeline	Pumping to Los Vaqueros Reservoir; balancing reservoir for flow control
Los Vaqueros Transfer Pipeline	72" Pipeline	200 – 400 cfs 19,600 feet	Transfer Facility to Reservoir	200 cfs capacity to reservoir; 400 cfs capacity from reservoir to Transfer Facility
Los Vaqueros Pipeline	90"-96" Pipeline	400 cfs 47,000 feet	Transfer Facility	Connects Transfer Facility with the Contra Costa Canal
Santa Clara Valley Water District (SCVWD)				
Central Pipeline	Pipeline	N/A	SBA	Terminal Reservoir; supplies Vasona Pumping Plant
Vasona Pumping Plant	Pump Station	N/A	Central & Alameda Pipelines	Delivers to Rinconada Force Main & Rinconada WTP
Almaden Valley Pipeline	Pipeline	N/A	Almaden Reservoir	Conveyance to Calero Reservoir
Almaden-Calero Canal	Open Canal	N/A	Almaden Reservoir	Conveyance to Calero Reservoir
Anderson Force Main	Pipeline	N/A	Anderson Reservoir	Conveyance to Coyote Pumping Plant
Calero Pipeline	Pipeline	N/A	Calero Reservoir	Conveyance to Cross Valley Pipeline
Cross Valley Pipeline	Pipeline	N/A	San Luis Reservoir	Coyote Pumping Plant to Almaden Valley Pipeline
Stevens Creek Pipeline	Pipeline	N/A	Sevens Creek Reservoir	Conveyance to Rinconada WTP
Blending Facility	-	45 mgd	SFPUC	Blends SFPUC Hetch Hetchy purchases with groundwater
Alameda County Water District (ACWD)				
Various conveyance and distribution facilities				
Alameda County Flood Control and Water Conservation District, Zone 7				
Various conveyance and distribution facilities				

KEY: cfs = cubic feet per second; MG = million gallons; mgd = million gallons per day; N/A = not available; PP = pumping plant; SBA = South Bay Aqueduct; SFPUC = San Francisco Public Utilities Commission; WTP = water treatment plant

Notes:
1. Facilities are owned by Reclamation but operated and maintained by Contra Costa Water District.

TABLE III-2
LOCAL SURFACE STORAGE AND GROUNDWATER BASINS

Facility	Type	Capacity (acre-feet)	Source Supply	Uses
Contra Costa Water District (CCWD)				
Los Vaqueros Reservoir	Offstream Reservoir	100,000	Old River Intake (Delta)	Water quality, emergency storage
Mallard Reservoir	Offstream Reservoir	2,100	Contra Costa Canal and Mallard Slough Intake (Delta)	Emergency storage, flow regulation, & blending; supplies Bollman WTP
Local Groundwater Basins[1]	Groundwater	N/A	Ygnacio, Clayton and Pittsburg/Antioch basins	M&I supply, primarily to Clayton users & Diablo Water District
Santa Clara Valley Water District (SCVWD)				
Local Groundwater Basins[1]	Groundwater	N/A	Local runoff & reservoir releases; onstream and offstream recharge facilities	M&I, irrigation, and environmental uses
Almaden Reservoir	Onstream Reservoir	1,586	Alamitos Creek	M&I, irrigation, and environmental uses
Anderson Reservoir	Onstream Reservoir	90,373	Coyote Creek	M&I, irrigation, and environmental uses
Calero Reservoir	Onstream Reservoir	9,934	Calero Creek	M&I, irrigation, and environmental uses
Chesbro Reservoir	Onstream Reservoir	7,945	Llagas Creek	M&I, irrigation, and environmental uses
Coyote Reservoir	Onstream Reservoir	23,244	Coyote Creek	M&I, irrigation, and environmental uses
Guadalupe Reservoir	Onstream Reservoir	3,415	Guadalupe River	M&I, irrigation, and environmental uses
Lexington Reservoir	Onstream Reservoir	19,044	Los Gatos Creek	M&I, irrigation, and environmental uses
Stevens Creek Reservoir	Onstream Reservoir	3,138	Stevens Creek	M&I, irrigation, and environmental uses
Uvas Reservoir	Onstream Reservoir	9,835	Uvas Creek	M&I, irrigation, and environmental uses
Pacheco Reservoir	Onstream Reservoir	6,143	Pacheco Creek	M&I, irrigation, and environmental uses
Vasona Reservoir	Onstream Reservoir	400	Los Gatos Creek	M&I, irrigation, and environmental uses
Alameda County Water District (ACWD)				
Niles Cone Groundwater Basin[1]	Groundwater	N/A	Alameda Creek Watershed; releases from Del Valle Reservoir & SBA	Principal source of local M&I supply
Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7)				
Livermore-Amador Valley Groundwater Basin[1]	Groundwater	240,000 – 250,000 (est.)	Local runoff & imported water recharge; Del Valle Reservoir releases	M&I and agriculture

KEY: N/A = not available; M&I = municipal and industrial; SBA = South Bay Aqueduct; WTP = water treatment plant

Notes:
1. *Though not considered property, local groundwater basins are listed with the agencies that use them.*
2. *Del Valle Reservoir, owned by DWR, stores both SWP water and local supplies (up to 7,500 acre-feet per year of reservoir capacity available for ACWD and Zone 7, each, to capture and store local flow from Arroyo Del Valle). This facility was described previously in this chapter with other State facilities.*

TABLE III-3
LOCAL RAW WATER TREATMENT PLANTS IN THE STUDY AREA

Facility	Capacity (mgd)	Source Water	Disinfection Technique
Contra Costa Water District (CCWD)[1]			
Bollman WTP	75	Contra Costa Canal	Intermediate ozone
Randall-Bold WTP	40	Contra Costa Canal	Pre- and post-ozone
Antioch WTP	24	Contra Costa Canal	Chlorine contact
Martinez WTP	14	Martinez Reservoir & Contra Costa Canal	Chlorine contact
Pittsburg WTP	32	Contra Costa Canal	Chlorine contact
Bay Point WTP	5	Contra Costa Canal	Chlorine contact
Santa Clara Valley Water District (SCVWD)			
Rinconada WTP	75	SBA, Del Valle &, San Luis reservoirs[2]	Chlorination (currently); ozonation (2006)
Penitencia WTP	42	Santa Clara Terminal Reservoir (SBA & Del Valle)	Chlorination (currently); ozonation (2006)
Santa Teresa WTP	100	San Luis Reservoir[3]	Chlorination (currently); ozonation (2006)
Alameda County Water District (ACWD)			
Mission San Jose WTP	10	SBA & Del Valle Reservoir	Ultra filtration
WTP Number 2	28	SBA & Del Valle Reservoir	Pre-ozonation
Newark Desalination Facility	5	Brackish groundwater	Desalination by reverse osmosis
Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7)			
Del Valle WTP	36	SBA & Del Valle Reservoir	Chlorine contact
Patterson Pass WTP	20	SBA	Chlorine contact

KEY: mgd = million gallons per day WTP = water treatment plant SBA = South Bay Aqueduct

Notes:
1. *CCWD owns and operates Bollman WTP, and operates Randall-Bold WTP, which is owned jointly with Diablo Water District.*
   The other WTPs listed are owned and operated by various communities served by CCWD.
2. *Rinconada WTP has the ability to receive flows from local reservoirs as well.*
3. *San Teresa WTP has the ability to receive flows from the SBA and local reservoirs.*

Operation of Existing Facilities

This section discusses the operation of major water resources projects within the study area, beginning with CVP and SWP Delta operations and followed by Los Vaqueros Project operations.

Existing CVP and SWP Delta Operations

Tracy Pumping Plant – The CVP Tracy Pumping Plant is used to export water from the Delta and deliver it to the Delta-Mendota Canal. The facility is authorized to divert up to 4,600 cfs during the peak of the irrigation season, decreasing to 4,200 cfs during the winter (non-irrigation) season. Decreased winter irrigation demands, starting in September, give way to the refilling of San Luis Reservoir with water pumped from the Delta at Tracy, less the water needed to meet demands. However, according to the Central Valley Project Improvement Act (CVPIA), diversion rates during the San Luis fill cycle may be reduced for fishery management. The amount, timing, and location of water deliveries from the Delta-Mendota Canal, apparent canal subsidence, siltation, facility design, and other factors have resulted in a mismatch between authorized Tracy Pumping Plant export capacity and Delta-Mendota Canal conveyance capacity. The Tracy Pumping Plant is usually operated at a constant, uninterrupted rate. Unless restrictions are imposed by regulatory or fishery requirements, when water supply supports it, the plant operates at the capacity limits of the Delta-Mendota Canal.

Harvey O. Banks Pumping Plant – The SWP Banks Pumping Plant lifts water 244 feet from the Delta to the California Aqueduct. Although the physical capacity of the pumping plant is 10,300 cfs, pumping at Banks is limited to 6,680 cfs (average daily) by flow restrictions at Clifton Court Forebay. Excess Banks pumping capacity may be used to pump CVP water as part of a Joint Point of Diversion (JPOD) operation during the summer months of July and August, when the CVP's Tracy plant is at maximum capacity. Banks exports may be temporarily reduced for fish protection purposes. Exports at Banks are reduced, at a minimum, for the period from April 15 to May 15 under the Vernalis Adaptive Management Program (VAMP). The "shoulder" periods of VAMP (April 1 through 15, and May 15 through 31) are likely periods for voluntary fish protection pumping curtailments due to the proximity of delta smelt to the pumps. Additional curtailment actions could occur during periods of juvenile Chinook salmon out-migration and adult delta smelt upstream migration in February and March. Between December 15, and March 15 Banks can increase pumping above 6,680 cfs if the flow in the San Joaquin River at Vernalis is greater than 1,000 cfs. This increase in permitted pumping is the lesser of 8,500 cfs or 1/3 of the flow at Vernalis.

Existing Los Vaqueros Project

Los Vaqueros Reservoir

The existing Los Vaqueros Project was constructed by CCWD to provide higher quality water for CCWD customers and emergency storage. Construction of the dam and conveyance facilities was completed in 1998, and the reservoir began operating in 1999. The Los Vaqueros Project is an offstream storage system. It diverts water from the Delta at the Old River Intake, pumps water to the Los Vaqueros Reservoir for storage, and delivers water by gravity from the reservoir to the Contra Costa Canal on an as-needed basis. Water also can be pumped directly from the 250 cfs Old River Pumping Plant to the Contra Costa Canal. Los Vaqueros releases are blended with other Delta diversions to improve the quality of CCWD's Delta water supply. Los Vaqueros Project facilities are illustrated in **Figure III-2** and described briefly below:

- **Old River Intake and Pumping Plant –** The Old River Intake diverts water from Old River in the Delta through a fish screen with an area of 1,250 square feet, and delivers it to the Old River Pipeline. The 10,500 horsepower (hp) pump station can pump up to 250 cfs.

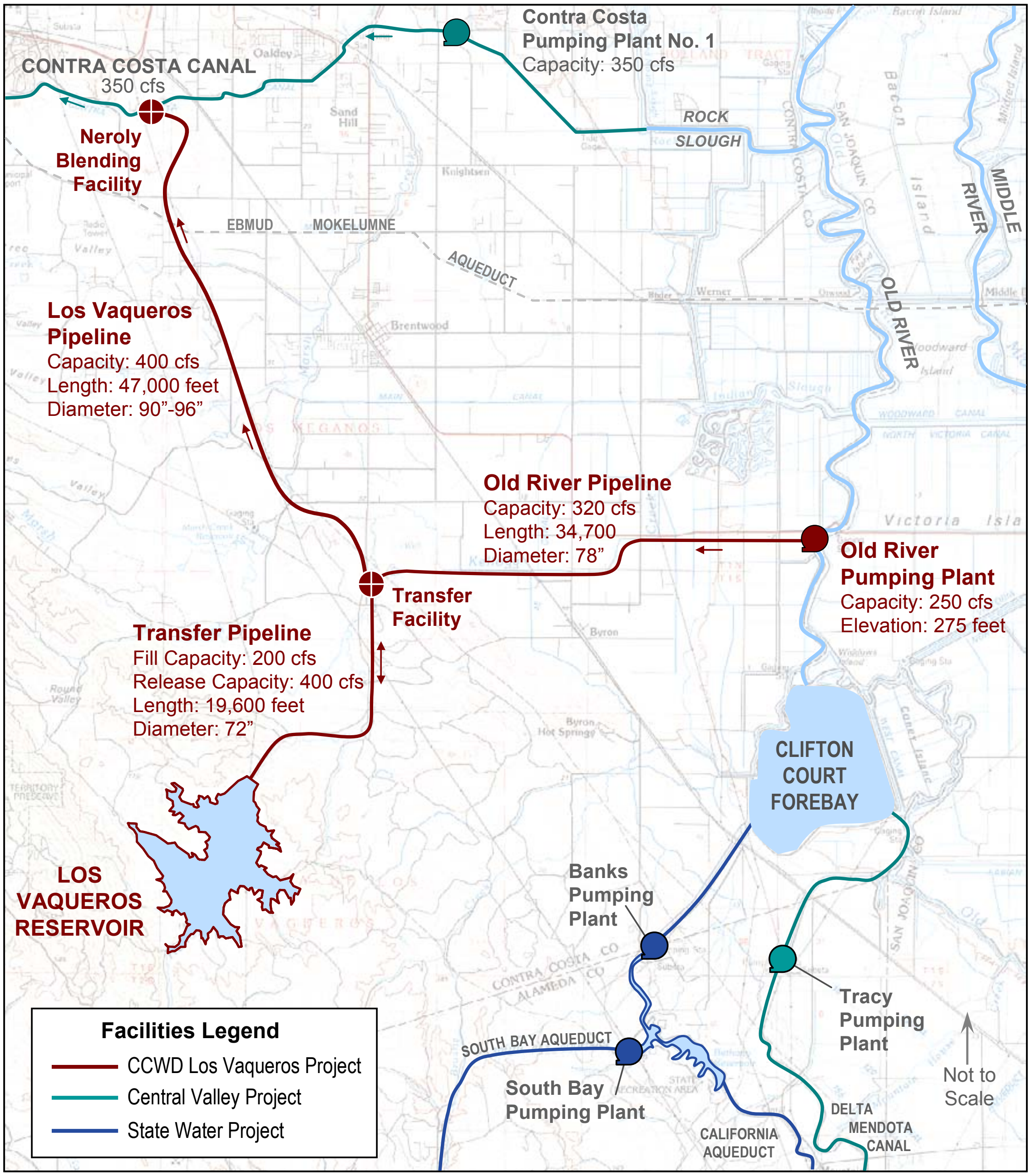


FIGURE III-2 – EXISTING LOS VAQUEROS PROJECT & RELATED FACILITIES

- **Old River Pipeline** – Old River Pipeline connects the Old River Pumping Plant to the Transfer Facility. The pipeline is approximately 34,700 feet long and 78 inches in diameter, and can convey up to 320 cfs.
- **Transfer Facility** – The Los Vaqueros Transfer Facility includes a pumping plant and a reservoir. The 8,400 hp Transfer Pumping Plant has a capacity of 200 cfs and delivers water to Los Vaqueros Reservoir. The Transfer Reservoir is a 4-million-gallon (MG) balancing reservoir that provides a free water surface and storage for flow control operations.

- **Transfer Pipeline –** The Transfer Pipeline connects the Transfer Facility to the Los Vaqueros Reservoir with approximately 19,600 feet of 72-inch-diameter pipe. The Transfer pipeline, regulated by Flow Control Station 1, can convey up to 200 cfs from the Transfer Facility to the reservoir, and up to 400 cfs from the reservoir to the Transfer Facility.

- **Los Vaqueros Reservoir –** The 100,000-acre-foot reservoir, located in the Kellogg Creek watershed, improves delivered water quality and provides emergency storage for CCWD.

- **Los Vaqueros Pipeline –** Los Vaqueros Pipeline has a capacity of 400 cfs and connects the Transfer Facility with the Contra Costa Canal. The Los Vaqueros pipeline consists of two continuous segments: the first is approximately 18,000 feet long and 96 inches in diameter, and the second is 29,000 feet long and 90-inch-diameter.

The existing LVP has three significant operational goals or objectives to perform simultaneously. One objective is to store high quality water for water quality blending purposes to improve the water quality served to CCWD customers. A second objective is to provide emergency storage to CCWD customers in case of severe interruption of Delta water supplies such as a Delta levee failure or a contaminant spill in the Delta. A third objective is to provide the operational flexibility to perform emergency storage and water quality functions while diverting water from the Delta during less sensitive fishery periods.

The existing LVP has the ability to divert up to 200 cfs to storage when Delta water quality conditions are favorable, releasing stored water later in the year for water quality blending needs. The source of stored water is typically Delta surplus flows during winter and spring months (November through June), and CCWD CVP contract water during late spring and summer. Los Vaqueros Reservoir is typically filled during wet weather months when Delta water is low in chlorides and surplus Delta flow is available. An exception is during April, when diversions may be curtailed to maintain higher in-Delta flows for winter-run Chinook salmon and delta smelt.

Water deliveries from Los Vaqueros Reservoir to the Contra Costa Canal are determined based on three parameters: (1) chloride concentration in Rock Slough, (2) chloride concentration in Old River, and (3) canal demand (which, in some periods, may exceed the maximum allowable diversion at Rock Slough and Old River intakes). CCWD uses chloride concentration as a general indicator of water quality in the operation of its facilities. Because of the proximity of the Rock Slough Intake to saltwater intrusions from San Francisco Bay, chlorides concentrations can be very high in Contra Costa Canal if the active intake is not switched to Old River during periods of high salinity. Water is delivered directly from Los Vaqueros Reservoir to the Contra Costa Canal if one of the three following conditions occurs:

Event 1: Old River water and Rock Slough water cannot be blended in any combination such that the resulting chloride concentration is below 65 milligrams per liter (mg/L) and Contra Costa Canal demand is satisfied. In this case, Los Vaqueros water would be used to dilute source water from the Delta to bring the chloride concentration below 65 mg/L.

Event 2: Old River water and Rock Slough water can be blended in a combination such that the resulting chloride concentration is below 65 mg/L, but the canal demand is too high to be accommodated by the pumping rate for this combination. In this case, Los Vaqueros water would be used to supplement source water from the Delta to meet canal demands.

Event 3: A severe interruption of Delta water supplies occurs (due to a levee failure or a contaminant spill in the Delta, for example). In this case, Los Vaqueros water would meet the canal demands entirely. This would be an infrequent, emergency operation.

Reservoir release typically occurs during the dry weather months when Delta water is high in chlorides and needs to be blended with a low-chloride source. One operational goal of the existing Los Vaqueros Project is to store water with a total chloride concentration of less than 50 mg/L. Thus, no filling occurs when chloride levels in the Delta are high or the reservoir is releasing.

Delta diversions for the Los Vaqueros Project also are governed by two biological opinions (BO): the 1993 National Marine Fisheries Service (NMFS) BO for Chinook salmon, and the 1993 U.S. Fish and Wildlife Service (USFWS) BO covering delta smelt. The USFWS BO requires CCWD to preferentially divert CVP water from the screened intake on Old River during the period from January through August, and requires operation of all three CCWD intakes and Los Vaqueros Reservoir as an integrated system to provide greater operational flexibility in minimizing fisheries impacts. In addition, if storage in Los Vaqueros is above emergency storage levels, the BOs require CCWD to cease all Delta diversions for one month in the spring, using releases from the reservoir to meet CCWD demands.

Existing Water Contracts and Supplies

This section describes existing water contracts and local supplies within the study area. The discussion begins with Federal and State water project contracts, followed by a description of local water agency contracts and supplies.

Federal Contracts

Two water districts within the study area have Federal contracts for CVP water: CCWD and SCVWD. **Table III-4** summarizes their contract entitlements and authorized points of delivery for CVP supplies. CCWD uses all of its CVP contracted water for M&I deliveries while almost 15 percent of SCVWD's CVP water is used for agricultural purposes.

State Contracts

Currently, three of the four districts within the study area have contracts for SWP water: ACWD, SCVWD, and Zone 7. **Table III-4** lists these districts, their annual contract amounts, and how their SWP water is delivered. For comparison, the CVP contracts in the study area (totaling about 347,500 acre-feet per year) represent just over 1.5 times the total SWP contracts in the study area.

TABLE III-4
FEDERAL AND STATE CONTRACTS WITHIN THE STUDY AREA

District	Contract Amount (acre-feet per year)	Point of Delivery
Federal Contracts		
CCWD	195,000	Delta at Rock Slough and/or Old River
SCVWD	152,500 (M&I: 130,000 Ag: 22,500)	San Luis Reservoir via Santa Clara and Pacheco Conduits
State Contracts		
SCVWD	100,000	South Bay Aqueduct
ACWD	42,000	South Bay Aqueduct
Zone 7[1]	80,619	South Bay Aqueduct

KEY: ACWD = Alameda County Water District
Ag = agricultural
CCWD = Contra Costa Water District
M&I = municipal and industrial
SCVWD = Santa Clara Valley Water District
Zone 7 = Alameda County Flood Control and Water Conservation District, Zone 7

Note:

1. *While considered an urban contractor, Zone 7 designates from about 6,000 acre-feet to 9,000 acre-feet of its annual deliveries for agricultural use.*

Source: District urban water management plans (CCWD Urban Water Management Plan, December 2000; SCVWD Urban Water Management Plan, April 2001; SCVWD Integrated Water Resources Planning Study, 2003; ACWD Integrated Resources Planning Study, August 1995; and Zone 7 Water Agency Urban Water Management Plan, October 2000 [with updates from District]).

Local Contracts and Water Rights

This section summarizes the water rights, local supplies, and contracted supplies of San Francisco Bay Area (Bay Area) water agencies within the study area. SCVWD, Zone 7, and ACWD each hold contracts with the Semitropic Groundwater Banking and Exchange Program (Semitropic GBEP). Semitropic Water Storage District allows its contractors to store water in its groundwater bank in years when unused water is available and then deliver the stored water to contractors by exchange, when needed. Contractors can deliver water to storage based on their permanent storage allocation, and may be given access to excess delivery capability (when available). Water is delivered from storage to the contractors through a combination of guaranteed pumpback capacity and exchange capacity, subject to availability. These and other local contracts and supplies are described below.

Contra Costa Water District – CCWD's water supplies come from a variety of sources in addition to the 195,000 AFY CVP entitlement drawn from Rock Slough and Old River described previously. Groundwater and recycled water provide about 4,000 acre-feet and 9,200 acre-feet annually, respectively. Local contracts and water rights that contribute to CCWD's water supplies are summarized below:

- East Contra Costa Irrigation District – CCWD has obtained an agreement for up to 12,200 AFY to be conveyed for M&I use within the irrigation district's service area.

- Sacramento-San Joaquin Delta – CCWD has rights to divert up to 26,700 AFY from the Delta at Mallard Slough under Water Rights License No. 3167 and Permit No. 19856. Under Water Rights Permit No. 20749, CCWD can divert up to 95,980 AFY of excess Delta flows to Los Vaqueros Reservoir for storage between November 1 of each year and June 30 of the succeeding year.

CCWD's Mallard Slough Diversion

- San Joaquin River – The City of Antioch holds the rights to divert up to 18,000 AFY from the San Joaquin River. In addition, Gaylord Container, Ultramar Diamond Shamrock, USS-Posco, and DuPont all hold rights to divert water from the San Joaquin River. The total maximum entitlement for these four industries is 44,650 AFY.

Note that these contracts are specific water rights of the identified parties, all of which are located within CCWD boundaries and contribute to CCWD's water demand. These water supplies are not considered reliable water sources because of the potential for San Joaquin River water quality to degrade during low flow (drought) conditions. For this reason, these diversion rights are only considered to contribute to the CCWD water supply when flow in the San Joaquin River reaches a specified level, ensuring acceptable water quality.

Santa Clara Valley Water District – SCVWD's water supplies consist of CVP and SWP contracts (discussed previously), local supplies, groundwater banking, recycling, and transfers. In addition, eight retail agencies within Santa Clara County contract with SFPUC to receive water supplies. SCVWD has one local contract and one permanent water transfer. These supplies are described below:

- SFPUC – Eight retail agencies in Santa Clara County contract with SFPUC to receive Hetch Hetchy and other local watershed supplies. The average annual SFPUC delivery in Santa Clara County has remained around 60,000 AFY in the last 10 years, although the annual delivery is projected to increase in the future. The contracts for these supplies expire in 2009.
- Semitropic Groundwater Banking and Exchange Program (Semitropic GBEP) – SCVWD has secured 200,000 acre-feet of permanent storage allocation and has an option to purchase an additional 150,000 acre-feet in the Semitropic GBEP. SCVWD is contractually guaranteed to be able to deliver 18,100 acre-feet to storage annually during wet years, or to receive up to 18,000 acre-feet of its stored water annually during drought years.
- Mercy Springs Water District – SCVWD, in conjunction with Pajaro Valley Water Management Agency and Westlands Water District, is entitled to a portion of the water from the permanent reassignment of the Mercy Springs Water District 6,260 acre-foot entitlement.

Alameda County Water District – In addition to SWP supplies described previously, a large portion of ACWD's water supply is received locally through the Niles Cone Groundwater Basin. The groundwater aquifer, which is used for both storage and supply, is recharged primarily from local runoff at Alameda Creek. ACWD also has three local contracts that contribute to its water supply:

- SFPUC – A 1984 water supply contract between the City and County of San Francisco and ACWD, as amended, provides for delivery of up to 15,400 AFY to ACWD from various connections to the Bay Division Pipelines.

- Semitropic Groundwater Banking and Exchange Program – According to its 2001 urban water management plan (UWMP), ACWD has secured 150,000 acre-feet of permanent storage in the Semitropic GBEP. ACWD is contractually guaranteed to be able to deliver 13,575 acre-feet to storage annually, or to receive a minimum of 13,500 acre-feet of its stored water annually via pumpback from the Semitropic aquifer into the SWP aqueduct. In addition, entitlement exchange is available in a quantity formulated from the annual SWP availability; ACWD's maximum entitlement exchange is 19,950 acre-feet in a full allocation year.

- Del Valle Reservoir Storage – ACWD and Zone 7 each have a water right permit issued by the State Water Resources Control Board to divert waters of Arroyo Valle into storage. These water right permits are acknowledged in a 1997 agreement between DWR, ACWD, and Zone 7. This agreement provides, in a typical year, 15,000 AF of storage space for local water inflow for subsequent beneficial use, divided between ACWD and Zone 7 as they may agree. Arroyo Del Valle flows may be delivered to ACWD through SBA turnouts under the exchange provisions of the contract.

Del Valle Reservoir

Zone 7 Water Agency – The Zone 7 area water supplies include contracts for imported water, local groundwater, surface water storage, and recycled water. The Livermore-Amador Valley groundwater basin has a storage capacity of about 240,000 AF. Recycled water contributes marginally to the area's irrigation water supply. In addition to the SWP Table A contract amount described previously, local contracts and a long-term water transfer contribute to Zone 7's water supply:

- Semitropic Groundwater Banking and Exchange Program – Zone 7 has secured 65,000 acre-feet in the Semitropic GBEP. Zone 7 is contractually guaranteed to be able to deliver 5,880 acre-feet to storage annually during wet years, or to receive up to 9,100 acre-feet of its stored water annually during drought years.

- Del Valle Reservoir Storage – ACWD and Zone 7 each have a water right permit issued by the State Water Resources Control Board to divert waters of Arroyo Valle into storage. These water right permits are acknowledged in a 1997 agreement between DWR, ACWD, and Zone 7. This agreement provides, in a typical year, 15,000 AF of storage space for local water inflow for subsequent beneficial use, divided between ACWD and Zone 7 as they may agree. Arroyo Del Valle flows may be delivered to Zone 7 through SBA turnouts under the exchange provisions of the contract.

- Byron Bethany Irrigation District – Zone 7 has entered into a long-term transfer agreement with Byron Bethany Irrigation District (BBID), providing a minimum transfer of 2,000 AFY.

Existing Water Supply Reliability

This section describes water supply reliability in the study area, beginning with an overview of general reliability conditions in the State, followed by discussions of CVP, SWP, and local supply reliability.

On the basis of information contained in the 1998 DWR California Water Plan (Bulletin 160-98), it is estimated that water demands in the State in 1995 for urban, agricultural, and environmental purposes under average and drought year conditions were about 79.7 million acre-feet (MAF) and 65 MAF, respectively, as shown in **Table III-5**. To address this demand, available statewide supplies from surface water, groundwater, and recycled and desalinated sources amounted to about 78 and 60 MAF for average and drought years, respectively. For the State as a whole, this represents a 1.8 MAF deficit in average years and a 5.4 MAF deficit in drought years.

TABLE III-5
ESTIMATED STATEWIDE WATER DEMANDS, SUPPLIES, AND SHORTAGES FOR 1995

Item	State of California	
	Average Year	Drought Year
Population (millions)	34.9	
Urban Use Rate (GPCPD)	241	247
Acres In Production (millions)	9.5	
Agricultural Use (AFPA)	3.5	3.6
Applied Water (MAF)		
Urban	9.4	9.7
Agricultural	33.3	34.1
Environmental	36.9	21.2
Total	***79.7***	***65.0***
Water Supply (MAF)		
Surface Water	65.1	43.5
Groundwater	12.5	15.8
Recycled / Desalinated	0.3	0.3
Total	***77.9***	***59.7***
SHORTAGE (MAF)	**1.8**	**5.4**

KEY: AFPA = acre-feet per acre MAF = million acre-feet
GPCPD = gallons per capita per day

Source: The California Water Plan, Bulletin 160-98, Appendix 6A, Regional Water Budgets with Existing Facilities and Programs, November 1998.

It should be noted that an update of the Water Plan is currently underway, and when finalized, relevant information on future water supplies and demands will be considered for the LVE. The April 2005 Draft of the update recognizes that significant water supply and quality challenges persist on local and regional scales. The major water supply reliability challenges for the primary study area occur during droughts and other emergencies. During drought periods, locally developed water supplies are very limited and imported water supplies can fall short of demands. Challenges facing the primary study area are described in the following sections.

Central Valley Project

Allocation of CVP water supplies for any given water year is based on forecasted reservoir inflows and Central Valley hydrologic water supply conditions, amounts of storage in CVP reservoirs, instream and Delta regulatory requirements, and management of 3406(b)(2) resources and refuge water supplies in accordance with implementation of the CVPIA. In years when CVP water supplies are not adequate to provide water to all water service contractors, CVP M&I water service allocations are maintained at 100 percent as the CVP agricultural water service contract allocations are reduced to 75 percent of contract amount in several incremental steps. Next, M&I CVP water service contract allocations are reduced to 75 percent of contract amount in several incremental steps as Irrigation CVP water service contract allocations are reduced to 50 percent of contract amount. The M&I CVP water service contract allocations are maintained at 75 percent of contract amount until Irrigation CVP water service contract allocations are reduced in incremental steps to 25 percent of contract amount. Finally, M&I CVP water service contract allocations are reduced in incremental steps to 50 percent until Irrigation CVP water service contract allocations are reduced in incremental steps to zero (Reclamation*, Finding of No Significant Impact, Municipal and Industrial Water Shortage Policy, Central Valley Project, California*, March 2005 Draft). **Figure III-3** shows the historical CVP south-of-Delta allocations for M&I and agricultural uses from 1988 through 2002, based on data provided by Reclamation's Central Valley Operations Office.

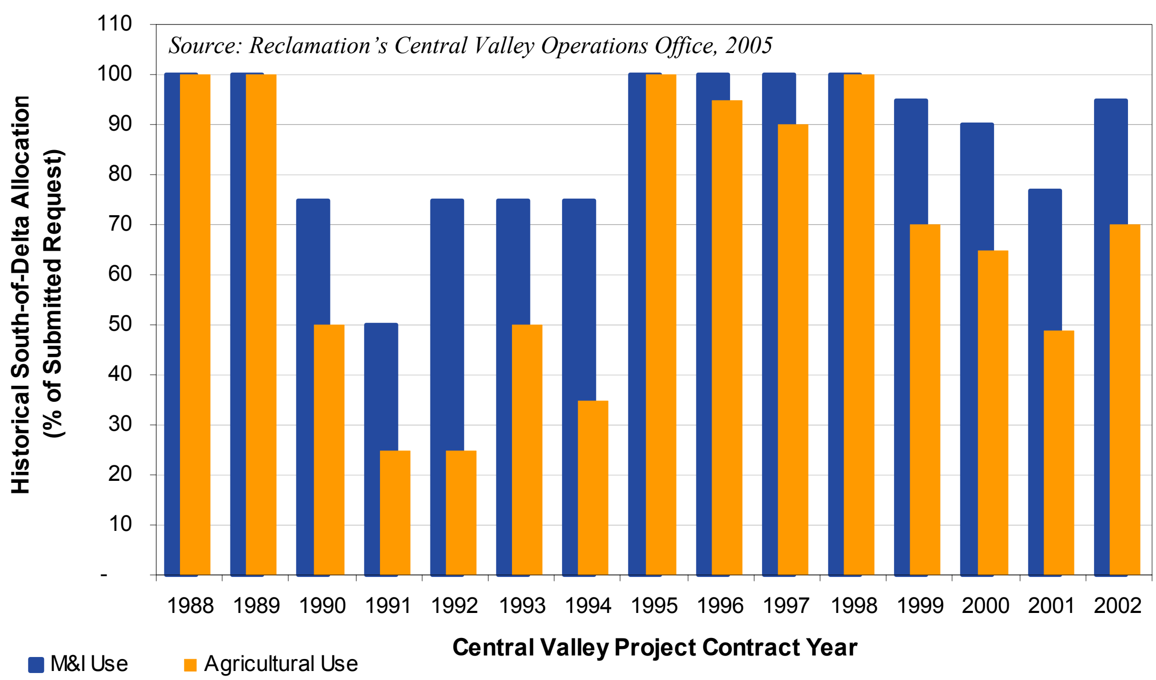


FIGURE III-3 – HISTORICAL CVP SOUTH-OF-DELTA ALLOCATIONS FOR M&I AND AGRICULTURAL USES FROM 1998 THROUGH 2002

Two major regulation changes in the 1990s have significantly affected the availability of CVP water for contract delivery: the CVPIA and SWRCB Decision 1641 (D-1641). The CVPIA, passed by Congress in 1992, was an attempt to restore the environment in the Central Valley and affect a more efficient use of CVP water. The CVPIA established the "protection, restoration, and enhancement of fish, wildlife and associated habitat" as a CVP purpose, and dedicated CVP water for wildlife uses. This resulted in decreased allocations and increased uncertainty for CVP contract holders.

The SRWCB issued D-1641 in December 1999, and later revised it in March 2000 to amend certain terms and conditions of the water rights of the CVP and SWP. This decision requires that the CVP and SWP be responsible for meeting Delta water quality flow and salinity objectives for fish and wildlife protection, M&I water quality, agricultural water quality, and Suisun Marsh salinity, as specified in the 1995 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (Bay-Delta Plan). Under this decision, the CVP and SWP often make additional releases from storage for meeting water quality objectives in the Delta.

The most recent projection of CVP water supply reliability is available in the Biological Assessment (BA) prepared for the Federal Endangered Species Act, as amended, Section 7 consultation on the Long-Term Central Valley Project Operations Criteria and Plan (OCAP). **Table III-6** displays the simulated deliveries to CCWD and SCVWD by water year type under the existing conditions (2001 level of development (LOD)). While the long-term averages of contract allocation for M&I and agricultural uses are comparable to the historical allocation, the projected allocations in dry years are substantially lower than the historical allocations, especially for agricultural uses.

TABLE III-6
SIMULATED CVP CONTRACT DELIVERY TO THE STUDY AREA
BY WATER YEAR TYPE FOR EXISTING CONDITIONS

		Delivery in AFY (Percentage of Total CVP Contract Amount)[1]		
District	**Item**	**Long-Term Average**	**Critical Dry Period (1929-1934)**	**Single Dry Year (1977)**
Contra Costa Water District		171,600 (88%)	117,000 (60%)	105,300 (54%)
Santa Clara Valley Water District	M&I	100,000 (77%)[2]	78,000 (60%)	70,200 (54%)
	Agriculture	13,725 (61%)	2,475 (11%)	900 (4%)
	Total	113,825	80,475	71,100

KEY: AFY = acre-feet per year CVP = Central Valley Project M&I = municipal and industrial

Notes:
1. *Numbers in parenthesis represent percentage of each district's total CVP contract amount (see Table III-4).*
2. *Includes provisions of SCVWD's Water Reallocation Agreement of April 1997, which converts the dry year delivery basis from 75 percent of historical use to 75 percent of contract quantity.*

Source: CALSIM II Study 3 (2001 Level of Development with CVPIA b(2) and EWA) for Long-Term Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment (June, 2004).

Reclamation has proposed to implement a Municipal and Industrial Water Shortage Policy for the CVP, and incorporate this M&I shortage policy in the CVP long-term contracts under negotiation for renewal in accordance with CVPIA Section 3404(c). In March 2005, Reclamation released the Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the proposed CVP M&I water shortage policy. Based on the March 2005 draft FONSI, the allocation methodology for CVP M&I water service contractors would be the same as under existing conditions (described above) when the CVP M&I allocations are greater or equal to 75 percent under the proposed alternative. However, in years when the CVP M&I allocations are less than 75 percent, water would be reallocated from the Irrigation CVP water service contractors to provide at least the public health and safety water quantity up to 75 percent of the total entitlement stipulated in the corresponding CVP M&I water service contract. The reallocation would be limited to the total amount allocated to the CVP agricultural water service contractors, if and when the water is available. In some years, allocations to CVP agricultural water service contractors are at or near zero. In those years, the increased allocations to M&I CVP contractors would not be fully realized.

The March 2005 draft FONSI further states that, of the 72 hydrologic years evaluated in CVP water supply studies under a 2020 LOD, CVP M&I water service contract allocations are less than 75 percent in 13 years under the existing allocation policy. Under the proposed alternative, M&I CVP water service contract allocations would increase in 9 of the 13 years by 5 to 13 percent. To provide these allocations, CVP agricultural water service contract allocations would decrease by 1 to 3 percent in these years, including two additional years when Irrigation CVP water service contract allocations would be zero or almost zero (as compared to 4 years in the No Action Alternative). This reduction of only 1 to 3 percent in the CVP Irrigation allocations in only 9 out of 72 hydrologic years is not a significant impact on surface water resources or on the CVP Irrigation allocations. Because water is reallocated between CVP M&I and irrigation users in the same water year, no change occurs in storage in CVP reservoirs or to allocations of water to refuge water supplies, instream flows, or senior water right holders. Because Delta exports are not limited due to capacity limitations during 9 years out of the 72-year hydrologic record, no adverse impact would occur to availability of Delta export capacity for other users.

State Water Project

SWP allocation policies are central to understanding the reliability of the project. Because the availability of SWP supplies is subject to hydrology, storage, and other factors, the project has developed policies for equitably delivering available supplies to contract holders in any given year. Article 18 of SWP water contracts outlines the reallocation of water among contractors in years of temporary shortage and addresses the potential of long-term shortages. The “Table A” amount is the maximum contractual amount that SWP contractors can request each year, and is given the first priority of delivery. Under shortage conditions, the current SWP policy is to equally impact all Table A water contractors.

Table III-7 summarizes the delivery request and allocation process for SWP contractors. In this example, Contractor 1 has 500 thousand acre-feet (TAF) under contract, while Contractor 2 has 300 TAF, and Contractor 3 has a contract for 400 TAF. At the beginning of the year, each contractor requests a different amount of water relative to their respective contract and needs.

In this example, the SWP determines that a 50 percent allocation is appropriate given the year's hydrology, and each contractor is assigned 50 percent of their Table A entitlement. Contractors 1 and 3 result in a shortage condition relative to their requested supplies, while Contractor 2 would receive more water than requested. Contractor 2's "surplus" water is then reallocated to Contractors 1 and 3 according to their share of Table A allocations.

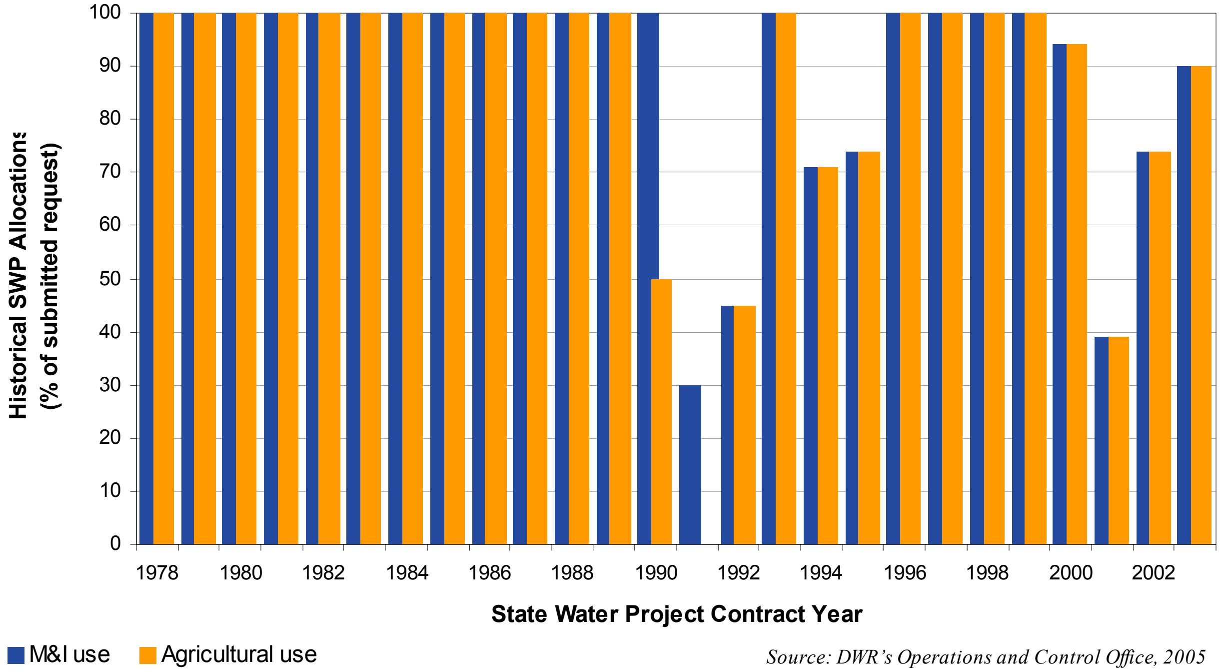
TABLE III-7
EXAMPLE OF STATE WATER PROJECT SHORTAGE POLICY

Contractor	Table A Amount	Request	50% Initial Allocation	Shortage	Surplus	Final After Reallocation
1	500	400	250	160	-	278
2	300	100	150	-	50	100
3	400	400	200	200	-	222

Article 21 of the contracts permits delivery of water in excess of Table A, when it is available, to contractors who request it. Article 21 water is recognized as water in excess of the amount required to meet the needs of the water project and, consequently, has a lower priority for delivery. When available, Article 21 water is distributed in the same proportion as Table A (*The State Water Project Delivery Reliability Report*, 2002).

Figure III-4 shows the historical SWP allocations for agricultural and M&I uses from 1978 through 2003. Prior to 1995, shortage provisions in the SWP contracts favored M&I contractors. In December 1994, DWR and the State Water Contractors entered into the Monterey Agreement, which lays out principles for amending the water supply contracts. Principle 2 of the Monterey Agreement states that each contractor will be allocated part of the total available project supply in proportion to the Table A amounts, irrespective of type of use (*CALSIM II Simulation of Historical SWP/CVP Operations*, November 2003).

The most recent projection of SWP water supply reliability is available in the BA prepared for OCAP consultation. Based on the projected percent allocations of SWP water determined with the CALSIM II modeling tool for the OCAP study, **Table III-8** displays the simulated deliveries by water year type to State Water Contractors in the study area under the existing conditions (2001 LOD). The comparison between these projected allocations with the historical allocations is not obvious because of the execution of the Monterey Agreement. However, the simulated SWP allocations are considered representative in both the *CALSIM II Simulation of Historical SWP/CVP Operations* (November 2003), and a review by DWR's Operations and Control Office as part of its effort for the Oroville Facilities Relicensing Program (Oroville Facilities Relicensing Program, Operations Modeling Workshop No. 2 on August 12, 2003).



Source: DWR's Operations and Control Office, 2005

FIGURE III-4 – HISTORICAL SWP ALLOCATIONS FOR M&I AND AGRICULTURAL USES FROM 1978 THROUGH 2003

TABLE III-8
SIMULATED SWP ALLOCATIONS IN THE STUDY AREA BY WATER YEAR TYPE

District	Delivery in AFY (Percentage of Total Table A Amount)		
	Long Term Average	Critical Dry Period (1929-1934)	Single Dry Year (1977)
Alameda County Water District	35,280 (84%)	17,640 (42%)	1,260 (3%)
Santa Clara Valley Water District	84,000 (84%)	42,000 (42%)	3,000 (3%)
Alameda County Flood Control and Water Conservation District, Zone 7	67,720 (84%)	33,860 (42%)	2,420 (3%)
KEY: AFY = acre-feet per year			

Note: Numbers in parenthesis represent percentage of each districts total Table A amount.

Source: CALSIM II Study 3 (2001 Level of Development with CVPIA b(2) and EWA) for Long-term Central Valley Project and State Water Project Operations Criteria and Plan Biological Assessment (June, 2004. Note that these numbers differ slightly from those provided by DWR in " Notice to SWP Contractors No. 05-08 - 2005 SWP Delivery Reliability Report Excerpts" circulated in May 2005 for agencies to prepare their 2005 Urban Water Management Plan.

Local Supplies

Each of the identified districts has different reliability goals and policies regarding local supplies and associated hydrologic uncertainty and seismic vulnerability. **Tables III-9** and **III-10** display the current and anticipated water supplies and demands for each district within the study area. Values were calculated from data obtained from each districts' urban water management plan and from district staff. Note that the hydrologic year types were defined differently in each districts' UWMP, but the following assignments can generally be assumed for local supplies: long-term average (1922 to early 1990s), critical dry period (1987 to 1992), and single dry year (1977).

Del Valle Reservoir, owned by DWR, is a storage reservoir for both local supplies and SWP water, of which the local portion is not subject to allocation but is instead delivered as needed. The contract between DWR, ACWD, and Zone 7 (discussed above), which makes 7,500 AFY of storage available for each district, is part of the local reservoir supplies, and thus, is included in the following discussions.

Existing Quality of Water Resources

This section describes current water quality conditions within the primary study area. The following sections discuss of the quality of Delta export supplies and local supplies within each agency.

In-Delta and Delta Export Water Quality

General factors influencing Delta water quality and the quality of water exported from the Delta to the study area are described in this section. Water quality in the Delta is highly variable and can be influenced by inflows from freshwater tributaries, agricultural and urban discharges, tidal influences from San Francisco Bay, and the operations of SWP and CVP facilities.

Specific activities that can cause contamination of Delta waters include the following: M&I wastewater discharges, urban runoff, highway runoff, agricultural runoff, pesticides, grazing animals, concentrated animal facilities, wild animals, mine runoff, recreational activities, traffic accidents/spills, seawater intrusion, geologic hazards, and solids and hazardous waste disposal facilities. The natural flushing of the Delta, source contamination controls, and existing water treatment practices mitigate this potential contamination. (CCWD *Water Quality Report*, 2004)

DWR maintains water quality data at the following M&I diversion locations in the Delta (summarized in **Table III-11**):

- SWP Harvey O. Banks Pumping Plant
- CVP Contra Costa Pumping Plant No. 1 (Rock Slough)
- CCWD Old River Intake (Los Vaqueros Project)
- CCWD Mallard Slough Intake

Contra Costa Pumping Plant No. 1

TABLE III-9
EXISTING LOCAL SUPPLIES WITHIN THE STUDY AREA BY WATER YEAR TYPE

	ACWD[1] (TAFY)			CCWD[2] (TAFY)			SCVWD[3] (TAFY)			Zone 7[4] (TAFY)		
Source	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**
Contracts[5] (excludes CVP/SWP)	15.0	12.9	11.7	34.4[7]	9.9	9.9	65.4	69.5	46.7	2.0	10.7	7.6
Surface Water[6]	4.5	0.4	0.1	-	-	-	85.4	48.4	44.4	8.0	2.8	0.3
Groundwater	17.7	38.6	35.5	4.0	4.0	4.0	N/A[8]	N/A[8]	N/A[8]	14.3	15.7	52.8
Desalination	5.6	5.6	5.6	-	-	-	-	-	-	-	-	-
Recycling	-	-	-	9.2	9.2	9.2	9.0	9.0	9.0	0.5	0.5	0.5
TOTAL LOCAL SUPPLIES	**42.8**	**57.5**	**52.9**	**47.6**	**23.1**	**23.1**	**N/A**	**N/A**	**N/A**	**24.8**	**29.7**	**61.2**

KEY: CDP = critical dry period (1987-1992, except for ACWD per Note 1); LTA = long-term average (1922-early 1990s); N/A = not available; SDY = single dry year (1977); TAFY = thousand acre-feet per year

Notes:

1. *The LTA condition represents the annual average amount of water available based on 1922-1992 historical hydrologic conditions. The CDP condition is an average of the Multiple Dry Year scenario in the UWMP and is based on the projected supply availability under 1988-1990 drought conditions. The SDY condition is based on projected supply availability under 1977 drought conditions. ACWD "Contracts" refers to SFPUC; values listed reflect 2005 SFPUC revised water supply availability figures for use in 2005 UWMP and differ from the 2000 UWMP. All numbers are subject to change pending completion of 2005 UWMP.*
2. *All hydrologic year type conditions represent projected local supplies.*
3. *The LTA condition represents the average supply available over the historic record (1922-1990), given existing facilities. The CDP condition projected as the equivalent to the 1987-1992 drought extended to a10-year duration and 1 percent probability severity event. The SDY condition is defined as the minimum operationally usable supply available during the historic record, equivalent to what would be experienced if the hydrology of 1977 were repeated with current facilities in place.*
4. *The LTA (1922-1999), CDP (1987-1992), and SDY (1977) conditions represent projected model outputs from the Zone 7 Annual Water System Model – Version 4.0, except groundwater, recycling, and Del Valle values, which are determined from information presented in UWMP and provided by Zone 7 staff.*
5. *Contracts refer to SFPUC Hetch Hetchy (ACWD, SCVWD); Semitropic (SCVWD, Zone 7); Mallard Slough Delta diversion, San Joaquin River diversions, & ECCID Purchase (CCWD); Mercy Springs Transfer (SCVWD); BBID Transfer (Zone 7). CVP and SWP contracts are shown in Table III-10.*
6. *Surface water supplies for ACWD and Zone 7 represent available storage in Del Valle Reservoir.*
7. *Maximum diversion at Mallard Slough (26,780 AFY) noted in Los Vaqueros Project of CCWD and Reclamation, Decision No. 1629.*
8. *Groundwater use is currently under evaluation by SCVWD and is not available at this time.*

Source: District urban water management plans and information provided by district staff (unless otherwise noted above); see references in Chapter XIII.

TABLE III-10
EXISTING WATER BALANCE WITHIN THE STUDY AREA BY HYDROLOGIC YEAR TYPE

	ACWD[1,2] (TAFY)			CCWD (TAFY)			SCVWD (TAFY)			Zone 7 (TAFY)		
Item	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**
Supplies												
Central Valley Project	-	-	-	171.6	117.0	105.3	113.0	80.5	71.1	-	-	-
State Water Project	35.3	17.6	1.3	-	-	-	84.0	42.0	3.0	67.7	33.9	2.4
Local (see Table III-9)	**42.8**	**57.5**	**52.9**	47.6	23.1	23.1	N/A[3]	N/A[3]	N/A[3]	24.8	29.7	61.2
TOTAL SUPPLIES	**78.1**	**75.1**	**54.2**	**219.2**	**140.1**	**128.4**	**N/A**	**N/A**	**N/A**	**92.5**	**63.6**	**63.6**
Demand[4]	71.1	67.1	67.1	173.1	173.1	173.1	446.6	446.6	446.6	66.9	66.9	66.9
Conservation	0.8	0.8	0.8	1.1	1.1	1.1	37.0	37.0	37.0	3.3[6]	3.3[6]	3.3[6]
WATER BALANCE[7]	**7.8**	**8.8**	**-12.1[9]**	**47.2**	**-31.9**	**-43.6**	**N/A[8]**	**N/A[8]**	**N/A[8]**	**28.9**	**-**	**-**

KEY: CDP = critical dry period (CVP/SWP: 1929-1934, Local: 1987-1992) N/A = not available TAFY = thousand acre-feet per year
LTA = long-term average (1922-early 1990s) SDY = single dry year (1977)

Notes:

1. *ACWD demands include Distribution system demands and groundwater system demands, (consisting of private groundwater pumping, aquifer reclamation pumping and groundwater outflows to prevent seawater intrusion). Under critically dry conditions, ACWD's groundwater system demands are assumed to be reduced by 4,000 AF/yr which would occur as a result of temporarily lowering groundwater levels. This temporary drawdown may subsequently reduce the quantity of groundwater outflows to the San Francisco Bay, thereby reducing the overall groundwater system demands.*
2. *ACWD supplies and demands are subject to change pending completion of ACWD's 2005 UWMP.*
3. *Groundwater use, a significant part of SCVWD's local supplies, is currently under evaluation and is not available at this time.*
4. *If a range of demands was presented in a District's UWMP, the "Middle" Scenario was used (ACWD and SCVWD).*
5. *Changes in demand during dry periods reflect partial reduction in saline outflows to San Francisco Bay resulting from naturally low groundwater levels.*
6. *Five percent conservation was assumed for Zone 7.*
7. *A negative water balance represents a shortage.*
8. *Demands not met by imported supplies and local surface supplies are typically met by groundwater pumping (see Note 3).*
9. *Preliminary modeling for ACWD's 2005 UWMP indicates no shortage during the 1977 period under 2005 demands. This is attributed to higher groundwater availability during the single dry-year scenario, lower private pumping demands, and recovery of groundwater reclamation pumping demand as a potable supply vis-à-vis desalination.*

Source: District UWMPs. See Tables III-7, III-10, and III-11 for breakdown of supplies. Conservation figures represent low (conservative) end of ranges presented in the UWMPs.

TABLE III-11
DELTA WATER QUALITY AT SELECTED DIVERSION LOCATIONS

Water Quality Parameter	SWP Banks Pumping Plant (1982 – present)	CVP Contra Costa Pumping Plant No. 1 (Rock Slough) (1990 – present)	CCWD Old River Intake (1990 – present)
Temperature	January: 44 – 50 °F August: 72 – 77 °F Significant diurnal variation (11°F in summer season)	January: 47 – 52 °F August: 75 – 80 °F	January: 46 – 51 °F August: 75 – 79 °F
Dissolved Oxygen	Winter: 10 – 12 mg/L Summer: 6 – 8 mg/L DO levels near saturation	6 – 13 mg/L Low levels in dry season, high levels in winter	Winter: 10 – 12 mg/L Summer: 6.5 – 8 mg/L DO levels near saturation
pH	6.5 – 9 units Significant diurnal variation (1.5 units in summer season)	6.5 – 8.5 units No seasonal trends.	6 to 9 units. High levels in summer (weak seasonal trends)
Turbidity	Typically < 30 NTU but occasional spikes up to 40 NTU	< 25 NTU with occasional peaks up to 50 NTU	< 20 NTU with spikes that exceed 30 NTU
Electrical Conductivity and Total Dissolved Salts	**EC:** 100 – 900 µS/cm **TDS:** 100 – 500 mg/L Lowest levels usually occur during late winter and spring	**EC:** 100 – 1,000 µS/cm **TDS:** 100 – 600 mg/L	**EC:** 150 – 800 µS/cm **TDS:** 100 – 450 mg/L Lowest levels during rainy season (January – April)
Bromide and Chloride	**Chloride:** < 80 mg/L w/ occasional spikes exceeding 100 mg/L **Bromide:** < 0.4 mg/L w/ frequent spikes exceeding 0.5 mg/L	**Chloride:** < 50 mg/L (spring), < 250 mg/L (dry season) **Bromide:** < 0.1 mg/L (spring), < 0.8 mg/L (dry season)	**Chloride:** < 150 mg/L, below 50 mg/L in winter and spring **Bromide:** < 0.6 mg/L (< 0.2 mg/L in winter and spring)
Nutrients	**Nitrogen:** *Nitrates* < 1.5 mg/L-N (higher late winter & spring) *TKN* 0.2 – 0.8 mg/L-N *Ammonia* < 0.2 mg/L-N **Phosphorus:** < 0.16 mg/L (half to three-quarters ortho-phosphate)	**Nitrogen:** *Nitrates* < 2.5 mg/L-N (higher late winter and spring) *Ammonia* < 0.08 mg/L **Phosphorus:** < 0.12 mg/L (ortho-phosphate < 0.07 mg/L)	**Nitrogen:** *Nitrates* < 1.0 mg/L-N *TKN* < 0.5 mg/L-N **Phosphorus:** < 0.12 mg/L (half to three-quarters ortho-phosphate)
Organic Carbon	Late winter and spring: 6 – 8 mg/L Summer and fall: 2 – 3 mg/L (nearly all in dissolved phase)	Winter: < 7 mg/L Summer and fall: 2 – 2.5 mg/L (90-100% in dissolved phase)	Winter: freq. exceeds 6 mg/L Summer: 2 – 3 mg/L (Nearly all in dissolved phase)
Alkalinity	30 – 90 mg/L No apparent seasonal trends	40 – 90 mg/L Weak trends show high rainy season levels	40 – 80 mg/L No apparent seasonal trends
Hardness	Generally > 50 mg/L as $CaCO_3$ Weak seasonal trends: mid-year (low), early year (high)	Weak seasonal trends Mid-year: 50 – 150 mg/L $CaCO_3$ Beginning year: seasonal spikes of 250 mg/L $CaCO_3$	50 – 150 mg/L $CaCO_3$ Weak seasonal trends: mid-year (low), early year (high)
THM Formation Potential	200 – 1,000 mg/L Higher during late winter and spring	Summer and fall: 300 – 1,000 mg/L Winter and spring: up to 800 mg/L	200 – 800 mg/L Higher during winter and spring

KEY:
$CaC0_3$ = calcium carbonate
CVP = Central Valley Project
DO = dissolved oxygen
EC = electrical conductivity
°F = degrees Fahrenheit
mg/L = milligrams per liter
N = nitrogen
NTU = nephelometric turbidity unit
SWP = State Water Project
TDS = total dissolved salts
THM = trihalomethane
TKN = total Kjeldahl nitrogen
µS/cm = microSiemens per centimeter

Source: CALFED Los Vaqueros Expansion Studies – Reservoir Water Quality Technical Memorandum (Final Draft, 2004)

From the 1940s through the mid-1970s, Delta water quality in the fall improved such that even in drier years water quality was better than the long-term average. During the 1970s and 1980s, the Delta experienced a dramatic degradation in salinity, which subsequently persisted through the wet years of the late 1990s, primarily as a result of increased diversions by Delta exporters and a shift in the timing of pumping from spring to fall to protect fish. Months with the highest water quality are currently worse than months with the poorest water quality prior to the mid-1970s (CALFED Bay-Delta Program, June 2005). Export water quality measured at three Delta intakes since the declines of the early 1980s is summarized in **Table III-11**. Additional, detailed water quality data can be found in the 2004 CALFED *Los Vaqueros Expansion Studies – Reservoir Water Quality Technical Memorandum (Final Draft)*.

Quality of Local and Other Supplies

All of the agencies within the study area currently receive Delta water supplies, but each agency has different water quality issues pertaining to these supplies, as summarized in **Table III-12**. Water quality within the service area of each agency depends on the quantity and quality of other water sources, internal water quality goals, use of Delta water for groundwater recharge or blending to meet internal goals, WTP locations relative to open channel flow or offstream reservoirs, and treatment processes in existing plants. The following section describes local water quality issues for each of the agencies. Water treatment facilities and their associated capacities and treatment methods were summarized previously in **Table III-3**.

Contra Costa Water District – CCWD currently operates two water treatment plants to ensure meeting water quality standards (Bollman and Randall-Bold WTPs). These facilities use a combination of conventional sedimentation/filtration and ozone treatment processes. Quality problems are typically related to algae and taste-and-odor events. The cities of Antioch, Martinez, Pittsburg, and Bay Point, located in the CCWD service area, also own and operate WTPs. These plants, which use conventional filtration processes, have concerns relating to diurnal fluctuations of temperature and pH in source water, and algae and taste-and-odor events. Because the majority of CCWD's water supply is taken directly from the Delta, these WTPs are highly sensitive to changes in Delta water quality.

Santa Clara Valley Water District – SCVWD currently operates three water treatment plants to ensure meeting water quality standards. Connected to both Federal and State water sources, SCVWD is concerned about salinity in the Delta (SBA diversions), but also has concerns about algal growth resulting from low water levels in San Luis Reservoir.

- **Penitencia WTP –** The Penitencia WTP is subject to variable water quality in the SBA, including fluctuations in temperature, pH, and dissolved oxygen. These often-rapid fluctuations can make it difficult to adjust operations. High concentrations of bromide, originating from seawater, aslo may cause problems during drought conditions. Because the District is adding ozone facilities, bromate formation, caused by the interaction between bromide and ozone, is a concern. SCVWD will be adding pH suppression facilities to help address bromate formation during high bromide conditions.

TABLE III-12
SUMMARY OF WATER QUALITY CONCERNS
FOR WATER AGENCIES WITHIN THE STUDY AREA

Water Agency	Water Quality Concerns	
Contra Costa Water District (from 2003 *Annual Water Quality Report)*	Delta Intakes: - seawater intrusion - agricultural drainage - recreational activities - regulated point discharges Reservoirs: - roads and parking lots - watershed runoff - wastewater treatment plant discharges	Contra Costa Canal: - gas stations - chemical/petroleum processing/storage - septic systems - historic landfills - military installations - agricultural drainage - urban runoff
Santa Clara Valley Water District	All Sources: - agricultural and urban runoff - recreational activities - livestock grazing - residential and industrial development Imported Sources: - seawater intrusion - wildland fires in open space areas	Local Sources: - commercial stables - historic mining practices - South Bay contamination Groundwater: - Septic tanks - Underground storage tanks - Solvent releases - Nitrate contamination from agricultural practices
Alameda County Flood Control and Water Conservation District, Zone 7	Groundwater: - salt loading in groundwater basins - septic tanks - gas stations - Lawrence Livermore National Laboratory groundwater cleanup program - recycled water irrigation deep percolations	Imported Sources: - salt and bromide concentrations affecting management of groundwater basin
Alameda County Water District (from 2003 *Water Quality Report)*	SBA: - agricultural drainage - wastewater treatment plant discharges - urban runoff - recreational activities - seawater intrusion (salt and bromide) - cattle grazing	Groundwater: - seawater intrusion - gas stations - contaminant plumes - leaking underground storage tanks - dry cleaners - metal plating/finishing/fabricating - sewer collection

KEY: SBA = South Bay Aqueduct

- **Rinconada WTP –** The Rinconada WTP currently receives water from the SBA and San Luis Reservoir. Algal episodes can cause taste-and-odor-related problems. The Low Point Improvement Project is currently addressing filter-clogging issues with algae that could enter the Pacheco Intakes with lower drawdown levels. Variable water quality from the SBA also is an operational issue at Rinconada WTP, as rapid changes in temperature, pH, and dissolved oxygen can impact facility performance. High concentrations of bromide may occur during drought conditions. SCVWD plans to add ozone and ultra violet (UV) disinfection.

- **Santa Teresa WTP –** Santa Teresa WTP currently receives the majority of its water supply from the San Luis Reservoir. When SBA water is delivered to Santa Teresa, issues would be similar to those for the Penitencia WTP.

Zone 7 – Zone 7 operates two water treatment plants to meet water quality standards. The Agency also currently has a groundwater management plan that attempts to reduce salt loading in groundwater supplies in the valley. Reduction in imported raw water salt concentrations would benefit these efforts.

- **Patterson Pass WTP** – Patterson Pass WTP receives SBA deliveries via Patterson Reservoir, which has historically buffered diurnal fluctuation of pH and temperature in the SBA and reduced the impact of turbidity events. However, these benefits have been reduced as the residence time in Patterson Reservoir has shortened due to increased demand from the WTP. Diurnally fluctuating temperature and pH, and algae events in the Delta and the SBA, have become more problematic. Organic carbon concentrations also are a concern due to the formation of byproducts from the plant's free chlorine disinfection process.

- **Del Valle WTP –** Del Valle WTP receives its water from the SBA and Del Valle Reservoir releases. The plant experiences diurnal fluctuations in temperature and pH, which can cause daily upsets in the clarification and filtration processes. The plant often receives water with high algae counts, likely due to the growth of algae in the open channel portions of the SBA, and has seen turbidity spikes of over 100 nephelometric turbidity units (NTU) due to algae and turbidity events in the Delta and flow changes in the SBA that cause resuspension of sediment. Operation of the plant appears to be significantly improved when as little as 10 percent of the water it receives is from Lake Del Valle.

- **Groundwater Recharge –** Salts, typically measured as total dissolved solids (TDS), are a concern for groundwater recharge and agricultural use in the Livermore/Amador Valley. Water imported to the valley through the SBA carries salts, which then accumulate in the groundwater basin, degrading groundwater quality. Zone 7 is currently pursuing a salt management program that includes the potential treatment of groundwater using high-pressure membranes and the export of concentrate from the valley. Agriculture water users also are affected by the presence of salt in water, which can reduce agricultural productivity.

Alameda County Water District – ACWD currently operates two water treatment plants, a blending facility, and a desalination facility to ensure meeting water quality standards.

- **Mission San Jose WTP –** Mission San Jose WTP receives SBA water from Bethany Reservoir and/or Lake Del Valle. The facility has historically had operational upsets due to diurnal fluctuations in temperature and pH, and turbidity spikes in the SBA. Algae have also caused taste-and-odor issues and upsets to the clarification and filtration processes. The plant has recently undergone upgrades intended to address the operational problems associated with temperature, pH, and turbidity by combining improved clarification with membrane filtration (ultrafiltration).

- **WTP No. 2 –** WTP No. 2 receives SBA water from Bethany Reservoir and/or Lake Del Valle. Problems associated with diurnal temperature and pH fluctuations have been moderated with the addition of carbonic acid ahead of pre-ozonation. The use of carbonic acid also has been shown to be effective in controlling bromate production in the late summer and fall months, when lower Delta outflows increase the influence of seawater.

Seasonal algae problems resulting in taste-and-odor events have been effectively controlled with ozonation.

- **Groundwater Recharge** – The use of imported SBA water was critical for reversing saline water intrusion from San Francisco Bay, the result of historic groundwater over-pumping. Enhanced recharge capacity, remediation through the aquifer recharge program, and expanded reliance on surface water treatment has enabled ACWD to develop a conjunctive use groundwater management plan that is both improving groundwater quality and preventing future saltwater intrusion while maintaining dry year supply. Watershed runoff in the summer and fall months is relatively high in TDS (about 800 mg/L compared to 500 mg/L in the winter and spring). SBA imports are used during summer months to maintain ideal groundwater levels in the Above Hayward Fault aquifer. Only in water deficient years, when import supplies are available, would SBA water be used for recharge during the winter or spring. It also is foreseen that SBA imports will play an important role in post-drought scenarios to rebuild healthy groundwater elevations.

- **Blending Facility –** High quality water purchased from SFPUC is blended with high hardness local groundwater to improve groundwater quality.

- **Newark Desalination Facility –** Brackish water is delivered from aquifer recharge program wells, located in salt contaminated pockets of the Niles Cone groundwater basin, to the Newark Desalination Facility. The water is first pre-treated to prevent crystallization, followed by filtration to remove silt and particulate matter from the water. High-pressure pumps then send the water through a series of reverse osmosis membranes to remove the salts. The final step is flow through a decarbonator to remove excess carbon dioxide. Finally, the desalinated water is blended with a fraction of brackish groundwater to achieve a balanced mineral content.

Physical Environment

This section describes the physical environment of the study area in terms of topography, geology, soils, geomorphology, climate and hydrology, flood control, air quality, and noise.

Topography

The topography of the study area is dominated by the confluence of California's two major rivers, the Sacramento River and the San Joaquin River, and the Coastal Range. The Delta consists of about 738,000 acres of low-lying land and interconnected waterways. The Sacramento River enters the Delta from the north, picking up additional flows from numerous tributaries, including Cottonwood Creek, Stony Creek, and the Feather and American rivers. The San Joaquin River enters the Delta from the south, and receives water from tributaries draining from the Sierra Nevada and Coast ranges. The Delta is crossed by about 700 miles of natural and artificial waterways with a total surface area of about 61,000 acres, forming more than 600 islands and tracts. Much of the land is below sea level and protected from flooding by about 1,100 miles of levees. The land surface on some islands is up to 20 feet below the water surface. The Delta drains via an interconnected estuary system that includes Suisun Marsh and San Francisco Bay.

Los Vaqueros Reservoir is located within the Kellogg Creek watershed, east of the Delta in the Coastal Range Mountains. The Kellogg Creek watershed is bounded by the foothills of the Diablo Range to the west, the upper portion of the Livermore Valley to the south, and foothills leading to the Sacramento Valley and Delta to the east and northeast. Kellogg Creek flows through the 16,650-acre watershed for about 15 miles to its terminus at Old River, near the Delta community of Discovery Bay.

Geology

The Delta is located in the Great Valley geomorphic province. This geologic province is composed of thousands of feet of sediments that have been deposited almost continuously since the Jurassic Period (approximately 160 million years ago). East of the Delta is the Coast Ranges geomorphic province. The Coast Ranges province consists of complexly folded and faulted Tertiary marine and non-marine formations and Cretaceous marine formations. Recent surface deposits have originated from alluvial fans, streams, and landslides.

Most of the upland areas within the Los Vaqueros Reservoir watershed are underlain by upper Cretaceous marine sedimentary rocks primarily of the Panoche formation (65 millions years old), but also including the Meganos, Moreno, and Deer Creek formations. Hard bedrock is typically encountered at depths of 25 feet or less, ranging from soft to hard and massive to fractured states. Rock outcrops are commonly found on ridges and hilltops, which is a common pattern in the Coast Ranges province. The low-lying areas comprise recent alluvial deposits derived from adjacent upland materials. Bedrock at the existing Los Vaqueros Dam site consists of interbedded sandstone and claystone.

Soils

The Delta comprises primarily of intertidal deposits of soft mud and peat. Delta islands are characterized by soft, organic soils that are subject to subsidence from oxidation and erosion. Soil associations of the poorly drained soils in the Delta, saltwater marshes, and tidal flats include Rindge-Kingile, Sacramento-Omni, and Joice-Reyes associations. Organic peat soils are up to 60 feet deep in some areas. To the west, two categories of soils have been identified in the foothills of the Coast Range. One category consists of soils on valley fill, basins, low terraces, and alluvial fans, including Brentwood-Rincon-Zamora, Capay-Sycamore-Brentwood, Capay-Rincon, Delhi, Clear Lake-Cropley, and Marcuse-Solano-Pescadero associations. The second category consists of steep, well-drained soils on terraces and mountainous uplands, including Tierra-Antioch-Perkins, Altamont-Diablo-Fontana, Los Osos-Millsholm-Los Gatos, Gilroy-Vallecitos, and Rock outcrop-Xerorthent associations. The two major soil associations found in the vicinity of Los Vaqueros Reservoir are the Altamont-Diablo-Fontana (well-drained clays and silty clay loams forming the uplands) and the Bentwood-Rincon-Zamora (well-drained clay and silty clay loams formed of alluvial material).

Geomorphology

The Great Valley geomorphic province is a nearly flat, 450-mile-long alluvial plain extending from the Tehachapi Mountains in the south to the Klamath Mountains in the north, and from the Sierra Nevada batholiths in the east to the coast ranges in the west (Hackel, 1966). Elevations across the alluvial plain generally range from a few feet below sea level to about 400 feet. The southern portion of the valley, which includes the study area, is referred to as the San Joaquin Valley. The San Joaquin Valley is a deep basin filled with a thick sequence of Jurassic to Holocene (recent) alluvial deposits that are eroded from the eastern Sierra Nevada Range and the western Coast Range. Alluvial sediments that form the central plain are transported to the valley primarily by tributaries of the San Joaquin River. Tertiary and Cretaceous outcrops border the central plain of the valley. A slight slope allows the valley to drain north into the Delta, which flows into the San Francisco Bay, a broad depression in the Franciscan bedrock that resulted from an east-west expansion of the San Andreas and Hayward fault systems.

The Coastal Range lies between the Pacific Ocean and the Great Valley Geomorphic Province, and stretches from the Oregon border to the Santa Ynez River. Discontinuous northwest-trending mountain ranges, ridges, and intervening valleys characterize this province. The valleys and hills of the Los Vaqueros Reservoir watershed often are defined by active and inactive seismic faults, including the Calaveras, Greenville, Las Positas, Pleasanton, Livermore, and Verona faults. Upland areas are flanked by large alluvial fans, and all of the major streams in the watershed are somewhat to deeply incised. The bed materials of the streams range from clayey to gravelly.

Climate and Hydrology

The San Francisco Bay-Delta (Bay-Delta) comprises the West Coast's largest estuary, encompassing approximately 1,600 square miles of waterways and draining over 40 percent of the freshwater in California. In the estuary, the Sacramento and San Joaquin Rivers flow from low lying inland valleys into the Delta – a labyrinth of islands, sloughs, canals and channels – continuing through Grizzly Bay, Suisun Bay and San Pablo Bay before emptying into San Francisco Bay and then the Pacific Ocean. Freshwater from the rivers mingles with saltwater from ocean tides, creating a rich and diverse aquatic ecosystem. Because of its geographical position, the Delta serves as the collection point for much of the runoff and resulting water supplies of northern California. It is through the channels of the Delta that this water must pass to satisfy the needs of the Delta, Bay Area, agricultural lands of the San Joaquin Valley, and densely populated southlands.

The climate of the study area is temperate, influenced by cool air moving inland from the Pacific Ocean and warm air amassing in the Central Valley. Winters are mild, with average low temperatures in the 30s. Summers in the Delta are dry and hot, with extreme temperatures in the 100s. A strong Pacific high pressure cell coupled with hot inland temperatures causes a strong onshore pressure gradient, which can produce strong afternoon winds during the summer. Mean annual precipitation ranges from about 12 inches in the valley to nearly 20 inches on the higher, Coast Range ridges. About 90 percent of annual precipitation occurs between November and April. Fog is common at night and in the early morning during the fall and winter, especially under clear, calm, and cold conditions.

Flood Control

The Sacramento and San Joaquin river basins receive flow from multiple rivers and streams, draining a combined area greater than 43,000 square miles. Flood management upstream of the Delta is provided by numerous multipurpose reservoirs on major tributaries. Most of the Delta lowlands are protected by locally constructed levees. Maintaining these largely non-engineered levees built on unstable peat foundations can be difficult. Each of the 70 islands and tracts that constitute the legal Delta has flooded at least once since they were originally reclaimed. Today, however, the potential impacts of levee failure in the Delta extend beyond local flood damages to include potential disruption of the major Delta water management systems that provide water to a large portion of Californians. Various small reservoirs in the study area provide local flood management benefits, including Los Vaqueros Reservoir.

Air Quality

Strong atmospheric inversions during the summer months trap and concentrate pollutants in the Central Valley. Strong onshore breezes, such as the summer "Delta Breeze," can move pollutants inland from urban areas around San Francisco Bay. These conditions create a high potential for air pollution in the Central Valley, although less so in the Delta. Air pollution potential in the Bay Area is high, especially for photochemical pollutants in the summer and fall. High temperatures increase the potential for ozone to build up. In the fall, northeasterly winds may carry ozone west from the San Joaquin Valley. Pollutants such as carbon monoxide and particulate matter, generated by motor vehicles, fireplaces, and agricultural burning, also can be problematic. Within the Los Vaqueros Reservoir watershed, winds are channeled through the region's hilly terrain at high speeds, dispersing pollutants and creating a low to moderate potential for air pollution. The Bay Area Air Quality Management District, created in 1955, regulates air quality in the region. Since the district's formation, air quality conditions in the Bay Area have improved significantly, including ambient concentrations of air pollutants and the number of days when air quality standards in the region are exceeded.

Noise

Ambient noise level is defined as the normal or existing level of environmental noise at a given location. In the Delta region, the major contributors to noise levels are traffic, farming activities, and watercraft. In the Los Vaqueros Reservoir watershed, wind turbines and high-voltage transmission lines are major contributors to ambient noise levels. Other noise sources in the watershed include remote and local traffic, farming activities, and occasional aircraft.

Biological Environment

This section discusses the biological setting for the project, vegetation and habitat, aquatic and fishery resources, and special-status species. Important to understanding biological conditions in the region is how the physical landscape of the Delta has been significantly altered over the past 150 years by human activities. Beginning in the late 1800s, settlers constructed levees to reclaim rich Delta marshlands and tidal wetlands for agriculture, creating islands in a network of interconnected channels. The channels were further altered in the 20th century to support navigation, and flood control, and to provide materials for Delta levees. Water resources development in the mid-1900s further altered the Delta environment, with water exported from the Delta to meet both local and statewide water demands. Although these factors have greatly changed the flow regime, hydrodynamics, and natural environment of the Delta, significantly reducing marshland and tidal wetland habitats, the Delta remains home to a diverse array of over 500 species of plants and animals. Although protective actions and restoration activities have had some success in the Delta, conflicts continue between the management and enhancement of Delta ecosystem functions and management of Delta water resources for beneficial uses.

Vegetation & Habitat

Dominant habitats in the Delta region include valley/foothill riparian and fresh and saline emergent wetlands. Although less prominent, other important habitats include seasonal fresh-water wetlands and nontidal freshwater, tidal freshwater, and brackish water emergent marsh.

- **Valley/foothill riparian scrub** typically occurs on islands or levees, and along unmaintained banks of creeks, ditches, and other waterways. The riparian zone along levee islands is usually very narrow, with additional areas scattered throughout the Delta system on islands, in backwater areas, in sloughs, and in thin bands along agricultural channels.

- **Tidal freshwater emergent habitat** includes portions of the intertidal zones of the Delta that support emergent wetland plant species intolerant of saline or brackish conditions. This habitat occurs primarily on instream islands and along unleveled, tidally influenced waterways, and provides habitat for many special-status species. The dominant vegetation for tidal freshwater emergent habitat includes California, river, and big bulrush; tule; cattails; and common reed. Suisun Marsh is the largest contiguous brackish wetland in California (USFWS, 2000).

- **Nontidal freshwater permanent emergent habitat** occurs on the landward side of Delta levees and in the interiors of Delta islands, mostly in constructed waterways, ponds, and low-lying agricultural areas. This habitat typically occurs in areas where soils are inundated or saturated for all or most of the growing season, including backwater areas and thin bands along rivers and channels where sediment has accumulated.

- **Saline (brackish) emergent habitat** includes the portions of San Francisco, San Pablo, and Suisun bays and the Delta that support plant species tolerant of saline or brackish conditions within the intertidal zone, or on lands that historically were subject to tidal exchange. The dominant vegetation for saline emergent habitats includes cordgrass, pickleweed, bulrush, glasswort, saltwort, saltgrass, arrowgrass, seablite, hairgrass, common reed, and algae.

- **Natural seasonal freshwater wetlands** include inland freshwater marshes that maintain surface water during only a portion of the year, and vernal pools associated with grasslands. Grasslands occur on islands within the Delta and in many outlying areas.

According to the Central Valley Wetlands Supply Investigation (USFWS 2000) the Delta Basin (including lands bound by the American River, Stanislaus River, Sierra Nevada foothills, Sacramento Deep Water Ship Channel, and Coast Range) contains 32,210 acres of privately managed wetlands, 92 percent of which occurs in the Suisun Bay area. Large seasonal wetlands managed for waterfowl also are found in the northwestern part of the Delta, west of the Sacramento Deep Water Ship Channel. These managed seasonal wetlands are of great importance to migratory waterfowl and shorebird populations during fall, winter, and spring, when bird populations in the Delta increase dramatically.

The most abundant vegetative cover type in the Los Vaqueros Reservoir watershed is grassland, covering nearly 13,700 acres, followed by valley/foothill woodland and forest, dominated by blue oak. Upland shrub cover types are most abundant on the western side of the watershed, and cover nearly 850 acres. Saline emergent wetlands cover just over 300 acres and include communities of salt-tolerant plants such as saltgrass, bulrush, cattail, and seepweed. This vegetative cover type is generally considered rare by Federal and State resource agencies, often supporting special-status species. Nontidal freshwater emergent vegetation covers nearly 50 acres and seasonal wetlands cover about 15 acres, represented by vernal pools in the eastern area of the watershed. Valley/foothill riparian vegetative cover, predominately composed of the Fremont cottonwood and remnant valley oak stands, is found along Kellogg Creek.

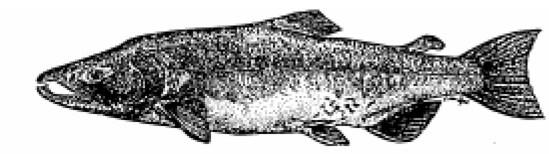
Aquatic and Fishery Resources

The Delta is home to a variety of resident and migratory fish and other aquatic species. Fish species common in the area include striped bass, threadfin shad, largemouth bass, American shad, longfin smelt, gobies, catfish, salmon, steelhead, and a variety of other freshwater and estuarine fish species. For some fish species, such as Chinook salmon and steelhead, adults migrate seasonally upstream through the Delta to spawning and juvenile rearing areas located in upstream tributary areas. Their young later emigrate from the upstream rearing areas, moving downstream through the Delta before entering coastal marine waters. Returning and outmigrating anadromous fish are particularly susceptible to flow and water quality conditions in the Delta, and predation. The Delta also provides habitat for a variety of invertebrates, including planktonic species such as mysid shrimp and copepods, and epibenthic species such as bay shrimp and amphipods.

The seasonal composition, distribution, and abundance of fish and invertebrate species within the Delta depends on a variety of factors related to habitat quality and availability. These factors include seasonal and interannual variability in hydrologic conditions, variation in water temperature and salinity, operation of the Delta Cross Channel and south Delta fish barriers, operation of screened and unscreened water diversions, and CVP and SWP water export operations. These factors affect different regions of the Delta in different ways, influencing flow direction, saline intrusion, and water surface elevations. Biological factors that affect individual fish species include the timing of spawning activity, egg incubation and hatching, larval dispersal, juvenile rearing, and, for a number of species, seasonal patterns in juvenile and adult migration. Several of the fish species inhabiting the Delta also support recreational angling, most notably striped bass, largemouth bass, and catfish.

Effect of Water Resources Development on Delta Fisheries

Migratory and resident fish populations in the Delta have declined significantly over the past century. Changes in the Delta environment, including land reclamation and water resources development, have contributed to this decline and the subsequent listing of winter-run Chinook salmon and delta smelt as threatened under Federal and State Endangered Species Acts. Other Delta fish species, including Sacramento splittail, longfin smelt, and green sturgeon, have been identified as species of concern. The USFWS *1996 Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes* identifies recovery objectives and criteria for these species. Chinook salmon, delta smelt, and Sacramento splittail are discussed in more detail below.



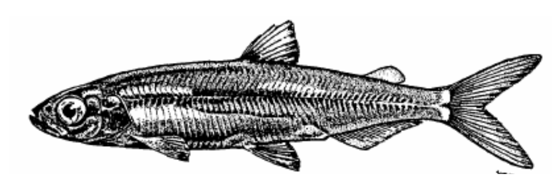
Oncorhynchus tshawytscha
(Chinook salmon)

Chinook salmon and other anadromous fish have been affected by water resources development and other changes throughout the Sacramento and San Joaquin river basins. Chinook salmon and other anadromous fish pass through the Delta when migrating upstream to spawn, and while out-migrating to the Pacific Ocean. Spawning and rearing occurs upstream of the Delta, primarily in the Sacramento River and its tributaries.

Delta smelt, unlike salmon, are a resident fish species primarily restricted to the Bay-Delta estuary system, relying on the habitat it provides during all life stages. Although once the most common pelagic fish in the Delta, a tenfold decline in the population of delta smelt has occurred over the past 20 years. Because delta smelt have a 1-year life cycle (born, mature, reproduce, and die in 1 year), they are very sensitive to environmental changes and have the potential for extinction in a single year of poor recruitment. Major population declines have typically occurred in unusually dry years when Delta outflows are significantly reduced, and during wet years with extreme Delta outflows. In dry years, water quality, water temperature, and food supplies become limiting factors. During very wet years, high outflows flush smelt out of the Delta, along with a significant portion of their food supply.

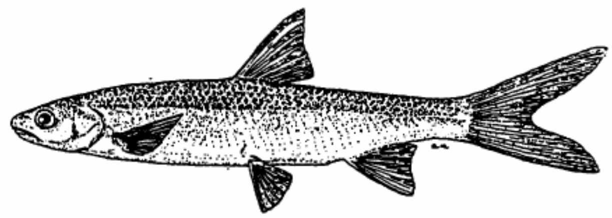
Delta smelt also experience high mortality as a result of south Delta export operations due to disorientation (caused by reverse flows and other changes in Delta flow patterns), physical entrainment, handling losses, and predation. They are particularly prone to impingement and entrainment mortality at Delta pumping facilities because they are not strong swimmers. Because they are relatively small (adult smelt are only 2 inches to 3 inches in length), predation from birds and other fish can be problematic. A relationship also may exist between delta smelt decline and the reduction in zooplankton production in the Delta (at the base of the smelt food web) caused by pollution and non-native introduced/competing species.

The preferred habitat for delta smelt is shallowwater in the brackish-freshwater mixing zone. The California Department of Fish and Game (CDFG) collects monthly data as part of a long-term fisheries survey program in the Delta. Trawl surveys conducted since 1967 indicate significant variability in smelt population from year to year. This variability, in combination with the reduced population, raises the concern that a single year of poor recruitment, as could occur during a severe flood year with large Delta outflows, could result in extinction of the species.



Hypomesus transpacificus McAllister
(delta smelt)

Although listed as threatened in 1999, USFWS downgraded Sacramento splittail to a species of concern in 2003 following a Federal court determination. Splittail are a relatively long-lived (5-7 years), endemic fish that prefers freshwater but can tolerate some brackish conditions. Like smelt, their population fluctuates annually depending on spawning success and other factors. Their preferred spawning habitat is submerged vegetation in temporarily flooded upland and riparian areas, primarily found in the lower reaches of Delta tributaries, flood bypasses, and dead-end sloughs.



Pogonichthys macrolepidotus Ayres (Sacramento Splittail)

Historically, splittail were once found throughout Central Valley lakes and stream, from Redding to Friant Dam. However, they are now primarily confined to the Delta and other parts of the Bay-Delta Estuary, Suisun Bay and Suisun Marsh, the Cosumnes River, and Napa and Petaluma rivers. Their decline is believed to be related to construction of onstream dams and diversions, and agricultural development, which have eliminated or drastically altered much of the lowland habitat splittail once occupied. Water quality, including temperature and agricultural and industrial pollution, also has been correlated to splittail abundance on the San Joaquin River. Unlike most salmon, splittail appear to be unable to navigate fishways and fish ladders, further reducing the extent of available upstream habitat (USFWS 1996 *Recovery Plan for the Sacramento-San Joaquin Delta Native Fishes*).

<u>Fish Losses at Delta Export Facilities</u>

Delta water export operations have had a significant impact on Delta fisheries. For example, over 1,800 agricultural and municipal pumping facilities are located within the range of delta smelt, and many more within the range of Chinook salmon. While many of these facilities are now screened and other preventative actions have been taken, large Delta export facilities still present both direct and indirect impacts on fisheries. Diversions from the major south Delta pumping facilities (Banks and Tracy pumping plants) can change local currents and hydraulic conditions within Old and Middle rivers and the lower San Joaquin River. These changes can attract fish into southern Delta areas where they are more vulnerable to mortality due to predation, entrainment, or fish salvage operations at the pumping facilities.

Photo by Steve Foss

Skinner Delta Fish Protective Facility

The magnitude of fish losses at the major CVP and SWP Delta export facilities is a function of many factors, including the volume of water exported, the density of fish vulnerable to entrainment at these facilities, and predation. Direct mortality occurs at various stages within the facilities, and includes pre-screen predation, screening losses, and handling and trucking mortality. Both the CVP Tracy Fish Collection Facility and the SWP Skinner Delta Fish Protective Facility divert fish away from pump intakes into holding facilities, where the fish are counted and measured, then transported and released elsewhere in the Delta. These salvage operations target fish greater than 20 millimeters (mm) in fork length, but juveniles less than 20 mm are most susceptible to entrainment and loss. Unfortunately, USFWS estimates that delta smelt suffer 100 percent mortality during catch, handle, transport, and release operations at both the CVP and SWP facilities (*Delta Smelt 5-Year Review,* March 2004). Furthermore, significant predation can occur in Clifton Court Forebay, in the channels approaching the pumping plants, and after capture and release.

Extensive data are available on species-specific salvage at both the CVP and SWP pumping facilities. The average density (number of fish per acre-foot) of fish present at both the CVP and SWP facilities is estimated monthly, covering a range of water year types. Fish density, the number of fish salvaged at the pumps, screening efficiency, and estimated handling and trucking losses are then used to estimate direct mortality at the pumps for salmonids, smelt, and striped bass. However, these estimates do not include predation and may underestimate actual losses. Delta smelt experience the highest salvage densities during May and June, and appear to be at highest risk during dry years when they are drawn farther upstream, and extreme flow years when juveniles can be washed downstream from the Delta. Historic entrainment rates also are available for the CCWD Old River Fish Screen Facility. Although state-of-the-art positive barrier fish screens, such as those used at CCWD's Old River facility, have proven very effective in reducing and avoiding entrainment and impingement of juvenile and larger fish species, these screens do not completely exclude planktonic fish eggs and larvae.

Fish Screens at CCWD's Old River Intake

A definitive link between south Delta pumping and overall fish abundance is difficult to establish due to the myriad of environmental factors that can affect individual species. However, biologists have identified an apparent relationship between delta smelt salvaged at CVP and SWP Delta pumping facilities, and both export volume and total Delta outflow. For example, flow reversals typically occur on the lower San Joaquin River and other channels when the ratio of Delta export rates to Delta outflow is high. One hypothesis is that reverse flow conditions may disorient juvenile smelt and make them more susceptible to predation and entrainment at the pumps, or prevent smelt larvae from being carried away from the pumps to preferred downstream rearing areas near the saltwater – freshwater mixing zone (USFWS *Delta Smelt 5-Year Review*, March 2004). Environmental factors, such as food supply and predation, also influence fish losses at south Delta pumping facilities. However, scientific evidence has not pointed to any single factor responsible for the decline of Delta fisheries.

Protective Actions

Various water quality, ecosystem restoration, and water resource operations regulations have been implemented to support the sustainability and recovery of threatened Delta fisheries. These regulatory actions and programs include the following (in chronological order):

- NMFS 1993 Long-term BO on the effects of CVP and SWP operations on winter-run Chinook salmon (superceded)
- USFWS 1993 BO on the effects of the Los Vaqueros Project on delta smelt

- USFWS 1993, 1994 and 1995 BOs of the effects of the CVP and SWP on Delta Smelt, delta smelt critical habitat, and Sacramento splittail (superceded)
- SWRCB 1995 *Water Quality Control Plan for the San Francisco Bay / Sacramento-San Joaquin Delta Estuary* (Bay-Delta Plan)
- 1996 VAMP
- Management of the full 800,000 acre-feet of CVP yield pursuant to Section 3406(b)(2) of the CVPIA (also known as (b)(2) water)
- CALFED Bay-Delta Program (CALFED) Environmental Water Account (EWA) management actions (2001 to present)
- Reclamation and DWR 2004 *Biological Assessment on the Long-term CVP and SWP Operations Criteria and Plan* (OCAP)
- NMFS 2004 Supplemental BO for CVP and SWP operations, April 1, 2004 through March 31, 2006
- USFWS February 2005 BO for delta smelt

Upstream from the Delta, various actions and programs, including the CVPIA's Anadromous Fish Restoration Program, have made significant contributions to the sustainability and recovery of anadromous fish species, particularly Chinook salmon. These actions have included removal of migration barriers, screening of diversions, and flow and temperature improvements in the Sacramento River. These actions have primarily targeted upstream conditions, but they have also improved flow and water quality conditions in the Delta.

A significant regulatory action in the Delta is the restriction of pumping at CVP and SWP south Delta export facilities to reduce fish losses. CVP and SWP facilities must comply with requirements established in the 2004 OCAP BO, which includes curtailment of pumping during specific periods to reduce fish losses when abundance is low and salvage rates are high. The potential water supply impacts of these pumping curtailments are partially offset by (b)(2) water and the EWA, discussed below and in **Chapter II**.

The EWA provides the resources and operational flexibility needed for participating agencies (Reclamation, USFWS, NMFS, DWR, and CDFG) to cooperatively manage water resources in a way that provides protection for at-risk fish species. Fish mortality estimates at the major pumping facilities, and other sampling survey data, are used to determine whether pumping curtailments or EWA actions are needed. The EWA provides benefits in two ways:

(1) It provides the opportunity for additional pumping curtailment (above regulatory requirements) for fishery protection and avoidance of command and control type pumping regulations

(2) It maintains water supply reliability to the export service area under voluntary curtailment times and, to a lesser degree, under required curtailment periods.

In addition to enabling pumping curtailment for fish protection without impacting CVP and SWP customers, the EWA also provides water to improve flow conditions in the Delta. While a general decline in delta smelt populations has occurred during the 4 years of the short-term EWA, this may not be an indication that the program is ineffective because the time-frame is too short to overcome natural variance in smelt populations. Further, the numerous factors affecting the abundance of delta smelt and other species make it difficult to assess or quantify the benefits of a program such as the EWA.

VAMP also contributes to fisheries protection in the south Delta. Since its initiation in 1996, VAMP has altered the movement of water in the south Delta to provide better spawning and rearing conditions and reduce reverse flow conditions that draw juvenile fish toward CVP and SWP pumping facilities. VAMP works in coordination with pumping curtailments, EWA actions, and other programs to promote the recovery of threatened fisheries.

The California SWRCB sets water flow and quality objectives in the Delta to protect the environment and other beneficial uses of the Delta. The SWRCB 1999 Water Rights D-1641 obligates the CVP and SWP to comply with the California SWRCB 1995 *Water Quality Control Plan for the San Francisco Bay / Sacramento San Joaquin Delta Estuary* (Bay-Delta Plan). The freshwater – saline water mixing zone in the Delta represents an area of high biological productivity in the aquatic environment. This zone provides ideal conditions for delta smelt and various other aquatic species. The location of this mixing zone varies depending on tidal conditions and Delta inflows and outflows. A standard, termed X2, was developed to track and regulate the location of the mixing zone, measured as the distance in kilometers (km) from the Golden Gate Bridge to where the salinity concentration is 2 parts per thousand (ppt) and the electrical conductivity (EC) is 2,640 micromhos per centimeter (μmhos/cm). The1995 Bay-Delta Plan manages the X2 location in San Francisco Bay and the Delta to benefit fisheries and other aquatic resources. The X2 location can be adjusted by altering the Delta's inflow-outflow ratio (releasing more water from upstream reservoirs to increase Delta inflow, for example).

Wildlife

The dominant wildlife habitat in the Delta is agricultural lands, which account for approximately 72 percent of the land area. Rabbits, foxes, mice, and numerous other mammals inhabit the agricultural lands, levees, and riparian areas of the Delta. Various species of snakes, turtles, frogs, and salamanders also are common. The Delta is home to a large number of resident bird species and migratory birds traveling the Pacific Flyway. Large-scale reclamation of tidal marshes in the Delta, and loss of wetlands in other portions of the State, have contributed to a decline in resident and migratory waterfowl over the past century. Common species include tundra swans, white-fronted geese, snow geese, greater sandhill cranes, northern pintails, and mallards.

The Los Vaqueros Reservoir watershed is home to numerous indigenous terrestrial and avian species. A Watershed Master Plan developed for the existing Los Vaqueros Project incorporates provisions for protecting area wildlife, including the golden eagle, California red-legged frog, California tiger salamander, Alameda whipsnake, and San Joaquin kit fox. CCWD has a conservation easement in the watershed to protect kit fox habitat on 4,150 acres.

Special-Status Species

The study area supports numerous special-status plant and wildlife species designated in accordance with Federal and State endangered species legislation. Delta smelt, Chinook salmon, and Sacramento splittail, among the species of special concern in the Delta, are described in greater detail previously in this chapter. Special-status species likely to occur in the Delta and Los Vaqueros watershed regions are listed in **Tables III-13** and **III-14**, respectively.

TABLE III-13
SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING IN THE DELTA REGION

Species	Regulatory Status	Habitat
Aster lentus Suisun marsh aster	FSC / 1B	Salt, brackish and freshwater marshes at or above the zone of tidal fluctuation. Elev. <150 m.
Carex comosa Bristly sedge	2	Coastal prairie, marshes and swamps (lake margins), valley and foothill grassland; Elev. 0-425 m.
Carex vulpinoidea Fox sedge	2	Marshes and swamps (freshwater), riparian woodland; Elev. 30-1,200 m.
Cirsium crassicaule Slough thistle	1B	Shallow water or saturated soils in chenopod scrub, marshes, swamps, and riparian scrub. Elev. 3 – 100 m.
Cryptantha hooveri Hoover's cryptantha	1B	Sandy soils in valley or foothill grassland. Elev. < 150 m.
Eleocharis parvula Small spikerush	4	Wet, generally saline flats in marshes and swamps. Elev. < 2,530 m.
Erysimum capitatum ssp. angustatum Contra Costa wall flower	FE / CE / 1B	Interior dunes with sparse herb and shrub cover. Elev. 3 – 20 m.
Gratiola heterosepala Bogg's Lake hedge-hyssop	CE / 1B	Shallow water along the margins of lakes, marshes, swamps, and vernal pools. Often in clay. Elev. 10 – 2375 m.
Hibiscus lasiocarpus Rose-mallow	2	Freshwater marsh, often in riparian areas with slow moving water. Canals, sloughs, ponds, and oxbow lakes. Elev. < 120 m.
Lathyrus jepsonii var. jepsonii Delta tule-pea	FSC / 1B	River and canal banks in association with freshwater and brackish marshes and riparian woodlands at or above the zone of tidal influence.
Lilaeopsis masonii Mason's lilaeopsis	FSC / CR / 1B	On newly deposited or exposed sediments, wood pilings, or sometimes on levee riprap, within the tidal zone. Elev. < 10 m.
Limosella subulata Delta mudwort	2	Edges of riverbanks and sloughs in marsh vegetation, rooted within the zone of tidal fluctuation. Elev. < 3 m.
Oenothera deltoides ssp. howellii Antioch Dunes evening primrose	FE / CE / 1B	Interior bluffs and dunes with sparse herb and shrub cover. Elev. < 30 m.
Potamogeton zosteriformis Eel-grass pondweed	2	Ponds, lakes, streams and marshes. Elev. < 1,860 m.
Sagittaria sanfordii Sanford's arrowhead	FSC / 1B	Shallow freshwater marshes, ponds, sloughs, streams and ditches. Prefers silty or muddy substrate. Elev. < 610 m.
Scutellaria galericulata Marsh skullcap	2	Meadows, marshes, and seeps (mesic) in lower montane coniferous forest. Occurrences in the Delta need further study.
Scutellaria lateriflora Blue skullcap	2	Mesic meadows, seeps, and freshwater marshes. Elev. < 500 m.
Desmocerus californicus dimorphus Valley elderberry longhorn beetle	FT	Elderberry shrubs in riparian habitat.
Thamnophis gigas Giant garter snake	FT / CT	Sloughs, canals, and other waterways; requires grassy banks and emergent vegetation; areas of high ground protected from winter flooding.
Emys marmorata Western pond turtle	FSC / CSC	Aquatic habitats with suitable basking sites. Nest sites most often found on gentle slopes (<15%) with little vegetation or sandy banks.
Grus canadensis tabidia Greater sandhill crane	CT	In summer, occurs near shallow lakes and marshes; in winter, in plains and valleys near freshwater.
Buteo swainsoni Swainson's hawk	CT	Nests in oaks or cottonwoods near riparian areas, forages in grasslands, irrigated pasture, and agricultural fields.

TABLE III-13 (CONT.)

Species	Regulatory Status	Habitat
Laterallus jamaicensis coturniculus California black rail	FSC / CSC	Tidal salt marshes, characteristically associated with heavy growths of pickleweed (Salicornia), but also in brackish and freshwater marshes.
Athene cunicularia hypugaea Western burrowing owl	FSC / CSC	Nests in burrows in sparse grassland, especially old ground squirrel burrows.
Agelaius tricolor Tricolored blackbird	FSC / CSC	Nests in emergent marsh and other wetlands; forages in wetlands, agricultural fields, pastures.
Lanius ludovivianus Loggerhead shrike	FSC / CSC	Open terrain with well-spaced lookouts.
Corynorhinus townsendii Townsend's big-eared bat	FSC / CSC	Found in all habitats up to alpine zone. Requires caves, mines, or buildings for roosting. Prefers mesic habitats where it gleans from brush or trees along habitat edges.
Antrozous pallidus Pallid bat	CSC	Primarily found below 6,000 feet in a variety of habitats, especially oak, ponderosa pine, and giant sequoia habitats. Roosts in rock outcrops, caves, and especially hollow trees.
Myotis ciliolabrum Small-footed myotis	FSC	Open stands in forests/ woodlands and shrublands. Forages among trees, over water. Breeds in colonies in buildings, caves, and mines.
Myotis yumanensis Yuma myotis	FSC	Usually occurs below 8,000 feet. Forages over open, still, or slow moving water and above low vegetation in meadows. Roosts in buildings, caves, or crevices. Nursery colonies in buildings, caves, or mines.
Falco peregrinus anatum American peregrine falcon	CE	Nests and roosts on protected ledges of high cliffs, usually near areas supporting large populations of other bird species.
Pelecanus erythrorhynchos American white pelican	CSC	Prefers aquatic habitats (ponds, lakes, streams)
Larus californicus California gull	CSC	Lake, rivers, ponds, irrigated fields.
Eremophila alpestris actia California horned lark	CSC	Sparse grassland, sagebrush, grazed pastures.
Accipiter cooperi Cooper's hawk	CSC	Found in wooded areas up to 9,000 feet in the Sierra Nevada, especially in Yosemite Valley area. Habitat destruction in its range has led to population declines. Frequently hunts along wooded edges.
Buteo regalis Ferruginous hawk	CSC	Open terrain in plains and foothills where ground squirrels and other prey are available
Circus cyaneus Northern harrier	CSC	Predominately grassland and wetland communities, however, use of variable of habitats.
Pandion Haliaetus Osprey	CSC	Prefer lakes, ponds, rivers and marshes bordered by trees. They require open water containing adequate fishing opportunities.
Buteo lagopus Rough-legged hawk	FSC / CSC	Prefer shrubland, prairies, and agricultural areas.
Accipiter striatus Sharp-shinned hawk	CSC	Prefer coniferous and deciduous forests, shrubland, and riparian areas.
Elanus leucurus White-tailed kite	FSC	Low rolling foothills or valley margins with scattered oaks, or river bottomlands with nearby marshes.
Dendroica petechia Yellow warbler	CSC	Prefers riparian woodlands, but also breeds in chaparral, ponderosa pine, and mixed conifer habitats with substantial amounts of brush.
Oncorhyncus tshawytscha Winter-run Chinook salmon	FE / CE	Adults first appear in the Sacramento River near Red Bluff in December and continue to pass Red Bluff through May; typically hold in the river before spawning on upper Sacramento River (river mile 284 to 298).
Oncorhyncus tshawytscha Spring-Run Chinook Salmon	FT / CT	Spawns on tributaries of Sacramento River, Deer and Mill creeks; generally ascend to natal streams during spring snowmelt run-off and spend the summer in deep pools with suitable water quality.
*Oncorhyncus t*shawytscha Late fall-run Chinook salmon	FC / CSC	Adults immigrate into the river system from mid-October through mid-April; begin spawning in January; and continue to spawn through mid-April. Embryo incubation occurs from January through June, rearing and emigration of fry and smolts from April through mid-October.
Oncorhyncus tshawytscha Fall-run Chinook salmon	FC / CSC	Adults immigrate into the river system from mid-October through mid-April; begin spawning in January; and continue through mid-April. Embryo incubation from January through June, rearing and emigration of fry and smolts from April through mid-October.

TABLE III-13 (CONT.)

Species	Regulatory Status	Habitat
Oncorhynchus kisutch Central CA coastal Coho salmon	FT / CE	Move upstream in response to increased stream flows caused by fall storms, especially in small streams when water temperatures are 4-14°C. Spawning sites typically at the heads of riffles or tails of pools where beds are present of loose, silt-free, coarse gravel and cover nearby for adults.
Oncorhyncus mykiss Central CA coastal steelhead	FT	Spawn in small streams where cool, well-oxygenated water is available year-round.
Oncorhyncus mykiss Central Valley steelhead	FT	Spawn in small streams where cool, well-oxygenated water is available year round.
Hypomesus transpacificus delta smelt	FT / CT	Estuarine waters of Delta.
Pogonichthys macrolepidotus Sacramento splittail	FT / CSC	Slow-moving stretches of Delta and Central Valley rivers.
Spirinchus thaleichthys Longfin smelt	FSC	Occur in salt and brackish water of estuaries.
Acipenser medirostris Green sturgeon	FC	Occur in lower reaches of large rivers, including the Sacramento, and seldom penetrate far upstream to tributaries.
Lampetra ayresi River lamprey	FSC	Known from the Sacramento River to southeast Alaska.
Lampetra hubbsi Kern Brook lamprey	FSC	Known from the upper San Joaquin River in Millerton Lake.
Lampetra tridentata Pacific lamprey	FSC	Found in upper drainages of the Sacramento-San Joaquin River system, American, Sacramento, and Napa rivers, and Sonoma and Walnut creeks.

KEY:

FEDERAL: U.S. Fish and Wildlife Service and National Marine Fisheries Service
FE Listed as Endangered by the Federal Government
FT Listed as Threatened by the Federal Government
FPT Proposed for Listing as Threatened
FC Candidate for Federal Listing
FSC Federal Species of Special Concern
BEPA Bald Eagle Protection Act of 1940

STATE: California Department of Fish and Game
CE Listed as Endangered by the State of California
CT Listed as Threatened by the State of California
CR Listed as Rare by the State of California (plants only)
CSC California Species of Special Concern

OTHER: California Native Plant Society
1A Plants presumed extinct in California
1B Plants considered rare, threatened, or endangered in California
2 Plants considered rare in California but common elsewhere

OTHER:
C = degrees centigrade
CA = California
Delta = Sacramento-San Joaquin Delta
M = meter

Source: California Natural Diversity Database 2004.

TABLE III-14
SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING IN THE LOS VAQUEROS WATERSHED

Species	Regulatory Status	Habitat
Amsinckia grandiflora Large-flowered fiddleneck	FE / CE / 1B	Grassy slopes below 1,200 feet in valley grassland and foothill woodland.;
Arctostaphylos auriculata Mt. Diablo manzanita	1B	Dry sandstone slopes below 2,000 feet in chaparral.
Astragalus tener var. *tener* Alkali milk-vetch	FSC / 1B	Seasonally inundated alkali flats with vernal pools, alkali playa, or valley grasslands.
Atriplex cordulata Heartscale	FSC / 1B	Alkaline flats with sandy soils in chenopod scrub, meadows, and grasslands.
Atriplex depressa Brittlescale	FSC / 1B	Alkaline scalds or clay in meadows, chenopod scrub, grasslands, and vernal pools (rarely with riparian / marshes).
Atriplex joaquiniana San Joaquin spearscale (=saltbush)	FSC / 1B	Seasonal alkali wetlands or sink scrub within chenopod scrub, meadows, and grasslands.
Calocortus pulchellus Mt. Diablo fairy lantern	FSC / 1B	Chaparral, cismontane woodland, riparian woodland, and valley and foothill grassland. Found in oak woodlands and brushy slopes.
Delphinium recurvatum Recurved larkspur	FSC / 1B	Chenopod scrub, cismontane woodland, and valley and foothill grasslands with alkaline soils up to 2,500 feet.
Erodium macrophyllum Round-leaved filaree	2	Open habitat with friable clay soils in valley and foothill grasslands and foothill woodlands.
Eschscholzia rhombipetala Diamond-petaled California poppy	FSC / 1B	Clay soils in valley and foothill grasslands of the inner coast range.
Helianthella castanea Diablo helianthella (=rock-rose)	FSC / 1B	From 500 to 4,000 feet in grasslands and foothill woodlands of the San Francisco Bay region.
Hesperolinon breweri Brewer's western-flax (=western flax)	1B	Serpentine soils in chaparral, woodlands, and valley foothill grasslands.
Hibiscus lasiocarpus *Rose mallow*	2	Marshes and swamps.
Lasthenia conjugens Contra Costa goldfields	FE / 1B	Vernal pools and moist habitats in valley and foothill grasslands.
Lathyrus jepsonii var. *jepsonii* Delta tule pea	1B	Freshwater and brackish marshes. Associated with bulrush, cattail, and coyotebrush.
Lilaeopsis masonii Mason's lilaeopsis	CR / 1B	Riparian scrub, freshwater and brackish marsh, within the tidal zone in muddy or silty soil, dunes.
Scutellaria galericulata Marsh skullcap	2	Lower montane coniferous forest, dry meadows and seeps, marshes, and swamps to 6,900 feet.
Tropidocarpum capparideum Caper-fruited tropidocarpum	FSC / 1A	Low alkaline hills below 500 feet in elevation within valley grassland communities.
Branchinecta longiantenna Longhorn fairy shrimp	FE	Lifecycle restricted to vernal pools.
Branchinecta lynchi Vernal pool fairy shrimp	FT	Lifecycle restricted to vernal pools.
Hygrotus curvipes Curved-foot hygrotus diving beetle	FSC	Vernal pools and shallow water in alkali flats.
Linderiella occidentalis California linderiella fairy shrimp	FSC	Lifecycle restricted to vernal pools.
Ambystoma californiense California tiger salamander	FC / CSC	Annual grassland and grassy understory of valley-foothill hardwood habitats in central and Northern California. Needs underground refuges and seasonal and perennial water sources for breeding.
Rana aurora draytonii California red-legged frog	FT / CSC	Breeds in slow moving streams, ponds, and marshes with emergent vegetation and an absence of predators.
Clemmys marmorata Western pond turtle	FSC / CSC	Requires aquatic habitats with suitable basking sites. Nest sites most often characterized as having gentle slopes (<15%) with little vegetation or sandy banks.
Masticophis flagellum ruddocki San Joaquin whipsnake (coachwhip)	FSC / CSC	Open, dry, valley grassland and saltbush scrub associations. May associate with mammals and use burrows for refuge and egg-laying.

TABLE III-14 (CONT.)

Species	Regulatory Status	Habitat
Masticophis lateralis euryxanthus Alameda whipsnake (=coachwhip)	FT / CT	Restricted to valley-foothill hardwood habitat of the Coast Range between the vicinity of Monterey and north San Francisco Bay.
Accipiter cooperii Cooper's hawk	CSC	Nests in riparian areas and oak woodlands; forages at woodland edges.
Agelaius tricolor Tricolored blackbird	FSC / CSC	Nests in dense thickets of cattails, tule, willow, blackberry, wild rose, and other tall herbs near freshwater.
Aquila chrysaetos Golden eagle	BEPA / CSC	Primarily nests on cliff faces and tall trees on hillsides.
Ardea Herodias Great blue heron (rookery)	CSC	Groves of tall trees, especially near shallow water foraging areas.
Athene cunicularia hypugaea Western burrowing owl	FSC / CSC	Uses rodent or other burrow for roosting and nesting. Frequents open grasslands and shrublands.
Falcomexicanus Prairie falcon	CSC	Breeds on cliffs, bluffs, and outcrops near large, open areas.
Haliaeetus leucocephalus Bald eagle	FT / CE	Nests near lakes, reservoirs, and large rivers. Winters near similar habitats at lower latitudes.
Vulpes macrotis mutica San Joaquin kit fox	FE / CT	Valley and foothill grasslands and chenopod scrub communities of the valley floor. Also use oak woodland, alkali sink scrubland, and vernal pool and alkali meadow communities. Require friable soil for denning.
KEY: See Key from **Table III-13**		

Source: California Natural Diversity Database 2004.

Social and Economic Environment

Existing social and economic resources described in this section include population, land use, employment and business/industrial activities, local government and finance, public health and safety, traffic and transportation, recreation and public access, utilities and public services, hazardous materials and waste, fire hazards, natural resources, and aesthetics.

Population

The number of persons living in California as of the year 2000 totaled an estimated 34 million persons. Over 500,000 people reside in the Delta region (*Census 2000*), concentrated primarily in the uplands and on the periphery. Communities include Stockton, Rio Vista, Walnut Grove, Discovery Bay, and Isleton. To the east, about 5.6 million people live in the five counties that encompass the most populated portion of the study area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara). The population within the vicinity of the existing Los Vaqueros Reservoir is over 1 million in Contra Costa County and 1.4 million in Alameda County.

Land Use

The legal Delta contains about 538,000 acres of agricultural land, comprising approximately 72 percent of the total land area. Cities and towns account for about 64,000 acres, and about 75,000 acres are undeveloped. The Los Vaqueros watershed area owned by CCWD consists of approximately 19,500 acres of land, with 1,460 acres covered by reservoir. Most of the land area in the watershed is zoned for agricultural uses, primarily grazing and dryland farming. A major portion of the agricultural property west of the reservoir has additional zoning restrictions that limit the use of pesticides and other practices that might affect water quality. Nearly all of the remaining watershed land is zoned for recreation or resource management use, including wind energy facilities. The East Bay Regional Park District owns lands bordering the western edge of the watershed that are open to recreation and grazing. Employment and Business/Industrial Activities

Agriculture is the primary industry in the Delta, with an average annual gross value of over $500 million. More than 75 percent of the Delta region's total production consists of corn, grain, hay and pasture. Recreation also supports an important seasonal service industry. Many residents of the Delta region commute to adjacent commercial and industrial centers in the Central Valley and the San Francisco Bay area. The Delta provides passage to two inland ports, in Stockton and Sacramento, which accommodate ocean-going cargo ships.

The Bay Area is one of California's busiest urban centers. Trade, transportation and utilities, government, and professional and business services are the predominate industries (2002). The major share of employment is in trade, transportation, and the utilities industry, with the majority of these jobs in the retail trade sector. The government (specifically local education) and professional/business services sector are the next major employers. Unemployment rates vary throughout the region, typically ranging from 5 percent to over 8 percent.

Local Government and Finance

Local government services in California are provided by county agencies, school districts, fire districts, water districts, and other special districts. These government agencies generally obtain their funding from State government revenue transfers, property tax payments from local residents, or through user fees. Portions of six counties lie within the legal Delta – Alameda, Contra Costa, Sacramento, San Joaquin, Solano, and Yolo – and portions of Santa Clara, San Mateo, and San Francisco counties cover other portions of the study area.

Traffic and Transportation

Federal Highways 5 and 205, and State Highway 99 pass through the periphery of the Delta. The central Delta is accessed via State Highways 4, 12, and 160, and numerous county roads. Most of the major roadways are elevated or constructed atop Delta levees. Numerous drawbridges accommodate traffic on both land and water. The Stockton and Sacramento deep water ship channels each carry ocean-going vessels about 80 miles inland from the San Francisco Bay. The Santa Fe and Southern Pacific railroads traverse the central and south Delta, respectively.

Vasco Road is the primary north-south access around and to the Los Vaqueros Reservoir watershed. Vasco Road connects with I-580, a major east-west eight-lane freeway linking the watershed with Alameda County to the west and San Joaquin County to the east. Vasco Road also functions as a commuter route between Brentwood/east Contra Costa County and the Livermore/Interstate-580/Tri-Valley area. Los Vaqueros Road and Walnut Boulevard provide access to the reservoir.

Utilities and Public Services

Several water agencies exist within the Delta region, including the North, Central, and South Delta Water Agencies, Byron-Bethany Irrigation District, East Contra Costa Irrigation District, and CCWD. The Pacific Gas and Electric Company and the Western Area Power Administration operate several high-voltage transmission lines across the Delta, and several natural gas extraction facilities in the Delta. Other public services are provided by a variety of local, State, and Federal service agencies.

Public services provided in the Bay Area portion of the study area include water service, sewer service, drainage and flood control, police and fire protection, solid waste disposal and schools. There are six water districts east of the Delta: CCWD, ACWD, SCVWD, Zone 7, EBMUD, and SFPUC. Those located in the LVE study area (CCWD, ACWD, SCVWD, and Zone 7) are described previously in this chapter. Major utility infrastructure within the Los Vaqueros Reservoir watershed includes two buried petroleum pipelines; three buried natural gas pipelines; an overhead electric transmission line; buried fiber optic communications lines; and a water conveyance pipeline that delivers water from Old River Pumping Plant to Los Vaqueros Reservoir, and conversely to the Contra Costa Canal. Police, fire, and other emergency services are provided by a variety of agencies on local, regional, State, and Federal levels.

Recreation and Public Access

The Delta accommodates various water- and land- based recreational activities, including boating, hunting, sport fishing, camping, picnicking, bicycling, wildlife viewing and photography, and hiking. Boating is the most popular recreation activity in the Delta, accounting for about 17 percent of visitors. Facilities available to boaters and other recreational users include marinas, city or county public access areas, and yacht or ski clubs. Recreational visitors account for over 12 million user days annually.

Table III-15 summarizes various recreation activities supported by Los Vaqueros Reservoir. Overall, the Los Vaqueros Reservoir has about 55 miles of hiking and multiuse trails, in addition to numerous features related to day-use picnicking and fishing. The majority of visitors to Los Vaqueros Reservoir use the south entry, where the marina and the majority of fishing piers are located.

Hazardous Materials and Waste

Residual pesticides may exist in the Delta region due to the agrarian nature of the area. The application of chlorinated pesticides, such as dieldrin, chlordane, and dichloro-diphenyl-trichloroethane (a.k.a. DDT), has been a common agricultural practice in the Central Valley, including the Delta area. A potential for localized petroleum fuel contamination also exists at area refueling stations and fuel transfer facilities. There are no known hazardous materials or waste sites identified in the Los Vaqueros watershed.

TABLE III-15
EXISTING RECREATION FACILITIES AT LOS VAQUEROS RESERVOIR

Area	Parking Spaces	Toilets	Display Panel / Water Station	Picnic Tables	BBQ Units	Fishing Piers	Description
Below Dam							
Walnut Staging Area	45	1	1	2	-	-	
Kellogg Creek Picnic Area	40	4	1	11	11	-	Three shade shelters over seven picnic tables
Interpretive Center	87	2	1	10	4	1	Outdoor amphitheater
Above Dam							
County Line Staging Area	29	1	1	1	--	-	
Los Vaqueros Staging Area	61	2	1	-	-	1	Ramp to fishing pier
Oak Point Picnic Area	-	-	-	7	3	1	
Marina	59	6	-	6	-	-	Marina; fish cleaning station; amphitheater
Knoll Picnic Area	21	-	-	18	9	-	
North west Cove	-	1	-	-	-	1	
TOTALS	**342**	**18**	**5**	**55**	**27**	**4**	

Fire Hazards

Fire hazards in the study area are typically attributed to human activities and land uses, rather than natural causes. Fire hazards in the Delta are primarily related to agricultural activities (equipment operation and burning practices), levee maintenance (vegetation removal and burning activities), and recreational activities. In the Delta, peat materials found naturally in the earth are highly flammable and can be difficult to suppress. In the Los Vaqueros Reservoir watershed, hazard abatement policies and actions primarily address the potential for grassland fires, and include fuelbreak networks, plowed control lines, prescribed burns, and other methods of minimizing the spread and intensity of wildfires. CCWD has created a fire management plan for the Los Vaqueros Reservoir watershed that addresses proactive planning (such as prevention programs and weather data), hazard abatement, and fire response.

Natural Resources

Natural resources in the study area primarily include land, water, and wildlife. In addition to food production, lands in the region provide habitat for wildlife. The CDFG manages thousands of acres in the region specifically for wildlife, including Lower Sherman Island and White Slough wildlife areas, Woodbridge Ecological Reserve, and Palm Tract Conservation Easement. Several natural gas wells and a large wind farm are also present in the region. Water resources in the study area are described earlier in this chapter.

Aesthetics

The Delta and surrounding lands provide important aesthetic resources in the region. The rural environment and wildlife of the Delta attract a large number of recreational users. While the Delta landscape has changed significantly over the past century, the Los Vaqueros Reservoir watershed has remained largely intact, with the exception of the reservoir facilities and nearby wind farm. From the highest hills east of the reservoir, panoramic views encompass the diverse landscapes of the Sacramento Valley and the Los Vaqueros Reservoir watershed. The natural beauty of the rolling hills attracts hikers, wildlife enthusiasts, and other recreational users.

Cultural Environment

This section briefly describes the archaeology, history, and ethnography of the study area.

Archaeology

California is rich in both prehistoric and historic archaeological remains. The Delta region was intensely investigated during the first half of the 20th century due to its high prehistoric population. Although much of the land area has been disturbed by agriculture, investigations have identified prehistoric village sites, temporary campsites, milling-related activity sites, and lithic scatters. Various Native American groups inhabited the Delta region, including the Valley Nisenan, Plains and Bay Miwok, Patwin, and Northern Valley Yokuts. European and American settlers rapidly displaced these groups and their cultures in the 18th and 19th centuries, but several Native American burial and cremation sites have been recorded. Further, over 170 sites in the Delta region are listed in the National Register of Historic Places (NRHP) and 10 sites are listed as California Historical Landmarks or Points of Historical Interest. Historic sites are primarily related to agriculture, but also include farmsteads, labor camps, ferry crossings, and boat landings.

According to evidence gathered from archaeological investigations conducted for CCWD, the upper Los Vaqueros Reservoir watershed experienced one of the longest sequences of human occupation yet identified in a single locality in the broader Bay-Delta region. In the period preceding Euroamerican contact, native peoples speaking four languages (Ohlone or Costonoan, Bay Miwok, Plains Miwok, and Northern Valley Yokuts) lived in and around the Kellogg Creek watershed. Archaeological and ethnographic sites include villages, ceremonial sites, burial grounds, and others. Based on a review of cultural resources mitigation documents, 32 prehistoric and 12 combination historic/sites exist within the Los Vaqueros Reservoir watershed, described in **Table III-16**.

History

Spanish settlers began to arrive in the region around 1775. As the mission system was established and acculturation progressed, a rapid and major reduction occurred in native California populations. Almost all of the native peoples who survived this period abandoned their indigenous hunter-gatherer lifestyle and become agricultural laborers.

TABLE III-16
SUMMARY OF KNOWN CULTURAL RESOURCES
IN THE LOS VAQUEROS WATERSHED

Cultural Resource Type	Number Identified		Number Identified
Rockshelter	4	Stone fence or corral	4
Milling station (historic / prehistoric)	18 / 2	Artifact scatter (historic / prehistoric)	2 / 1
Petroglyph	1	Water management feature	9
Occupation site	10	Rock feature or shelter	3
Ranch headquarters or ancillary facility	21	Burial site (historic / prehistoric)	5 / 1
Homestead	1	Other feature	2

In the early 1840s, the 17,000-acre Rancho Canada de los Vaqueros land grant (which included the Kellogg Creek watershed) was issued to private owners. The land was used for grazing and other agricultural activities until California was annexed to the United States in 1848, at which time American settlers arrived and began claiming portions of the land. Grazing continued and the land remained in primarily single ownership until plans for Los Vaqueros Reservoir materialized in the 1960s and 1970s.

Ethnography

California is home to many linguistically and culturally diverse Native American groups. The indigenous residents were primarily from four tribal groups: Ohlone or Costonoan, Coast Miwok, Plains Miwok, and Northern Valley Yokuts. Different groups of Ohlone lived in the Bay Area, and tended to be less transient than neighboring tribes due to the abundance of resources in and around the bay. The Coast Miwok lived in small bands by hunting and gathering. The Plains Miwok and Northern Valley Yokuts were also hunter-gatherers, but focused their settlement along major stream courses with abundant salmon runs. The Miwok and Yukuts traveled periodically to avoid floods and summer heat, collect seasonal resources, hunt large game, and engage neighboring groups. Today, a diverse international community, comprising people of many cultures and ethnic backgrounds, has replaced these indigenous tribes.

FUTURE WITHOUT-PROJECT BASELINES

Identification of the magnitude of potential water resources and related problems and needs in the study area is not based only on the existing conditions described in this chapter, but also on an estimate of how these conditions may change in the future. Two conditions were identified to help define the extent of potential resources problems/opportunities and for use in comparing the relative effectiveness of alternative plans to be formulated to address these problems/opportunities:

- **California Environmental Quality Act (CEQA) Baseline and No Project Alternative –** Development of this baseline, to be presented in the Environmental Impact Report (EIR) that will accompany the LVE feasibility report, is necessary to meet the requirements of CEQA.

The California Environmental Quality Act (CEQA) Existing Conditions Baseline represents conditions at the time the Notice of Preparation is filed. The CEQA No Project Alternative, on the other hand, also includes actions that are reasonably expected to occur in the future. Under CEQA, all alternatives (including the CEQA No Project Alternative) are compared against the Existing Conditions Baseline. Because this Initial Alternatives Information Report (IAIR) is primarily focused on informing Federal decision-makers, the CEQA No Project Alternative is not discussed herein.

- **National Environmental Policy Act No Action Alternative** – The National Environmental Policy Act (NEPA) No Action Alternative (also considered the NEPA benchmark) is developed in the Environmental Impact Statement (EIS) to meet the requirements of NEPA. Under this without-project future condition, only actions reasonably expected to occur in the future would be included. This would include projects and actions that are currently authorized, funded, permitted, and/or highly likely to be implemented. Under NEPA, all alternatives are compared against the NEPA benchmark (No Action Alternative). Differences between the NEPA and CEQA baseline comparisons are shown in **Figure III-5**.

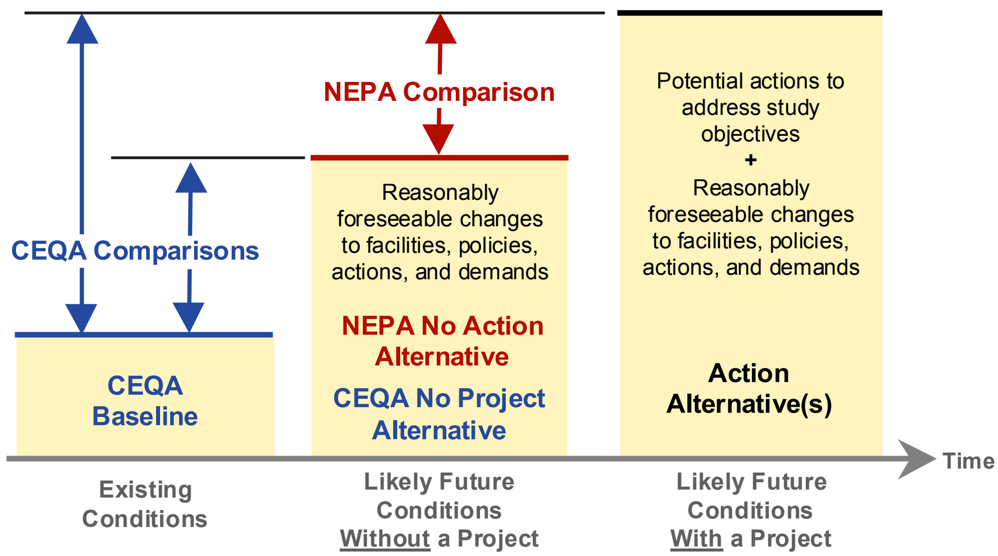


FIGURE III-5 – DIFFERENCES BETWEEN NEPA AND CEQA ANALYSES

Predicting future changes to the physical, biological, social, and economic environments in the study area is complicated by ongoing programs and projects, particularly those related to CALFED, the CVP, and SWP. It is difficult to estimate how these individual projects may influence future conditions because they are not part of a well-defined, integrated or regional plan. Various ongoing water supply reliability, water quality, and ecosystem restoration efforts in the study area are likely to be implemented over the planning horizon (the LVE utilizes a 100-year period of analysis). However, these efforts may not meet the conditions generally required for projects to be included in the NEPA No Action Alternative (authorized, funded, and permitted, or under construction at this time). Several significant projects that could affect conditions in the primary study area, and are highly likely to be implemented in the future, are described below. These projects may be appropriate for inclusion in the NEPA No Action Alternative, described in **Chapter VII**.

- **Environmental Water Account** – The EWA program recently received authorization through 2011 under the Water Supply, Reliability, and Environmental Improvement Act (2004). The corresponding EIS/EIR under preparation will evaluate a planning horizon through 2030. However, it is likely that the EWA (or a similar program) will continue in the long-term future to promote fish recovery.

- **Water Use Efficiency** – CALFED seeks to accelerate implementation of cost-effective actions of its Water Use Efficiency (WUE) Program to conserve and recycle water throughout the State. As with the EWA, it is believed that some form of this program will continue into the long-term future. CCWD, SCVWD, Zone 7, and ACWD already are implementing WUE programs in their service areas, and have plants to implement additional projects in the future. The unmet water demands described later in this chapter assume that these programs are in place.

- **South Delta Improvements Program** – DWR and Reclamation are responsible for implementing CALFED's South Delta Improvements Program (SDIP), which includes providing more reliable, long-term export capability by Federal and State water projects, protecting local diversions, and reducing impacts on San Joaquin River salmon. Specifically, proposed actions in the SDIP include placing a fish barrier at the head of Old River, constructing up to three hydraulic barriers in south Delta channels, dredging and extending some agricultural diversions, and increasing the diversion capability of the Banks Pumping Plant at the Clifton Court Forebay from 6,680 cfs to 8,500 cfs during certain periods. The SDIP is still in the environmental review phase and not yet approved, but was included in early consultations for OCAP. Because it is an essential element of the CALFED Record of Decision (ROD) and has broad Federal and State agency support, there is a strong likelihood that it will be implemented in the future.

- **Operation Criteria and Plan** – Numerous actions contained in the 2004 revision to the 1992 OCAP will be implemented to address how the CVP and SWP will operate in the future as new projects come on-line and as water demands increase. This includes increasing south Delta pumping at Banks to 8,500 cfs as part of the SDIP.

- **Trinity River Restoration Plan** – It is expected that elements of the December 2000 ROD for the Trinity River Restoration Plan will be implemented. This includes reducing annual exports of Trinity River water to the Sacramento River from 74 percent of Trinity River flow to 52 percent. A reduction in high quality Trinity River diversions to the Sacramento River may affect water quality conditions in the Delta.

- **Folsom Dam Modifications** – Modifications consist of enlarging existing outlets and constructing new low-level outlets to increase releases during lower pool stages, and revising the surcharge storage space in the reservoir. This project may influence project operations or flow conditions in the Delta.

- **Freeport Regional Water Project –** The Freeport Regional Authority (comprised of Sacramento County Water Agency and East Bay Municipal Utility District (EBMUD) in close coordination with Reclamation is developing a joint regional water supply project on the Sacramento River near the community of Freeport. The Freeport Regional Water Project will supplement aggressive water conservation and recycling programs in the East Bay and help meet future drinking water needs in the central Sacramento County area. In April 2004, a Final EIS and EIR were released in accordance with NEPA and CEQA , respectively.

- **Phase 8 Short-Term Agreement** – It is highly likely that some of the 45 projects identified in the Phase 8 Short-Term Settlement Agreement will be implemented, including the dedication of up to 185,000 acre-feet of water for environmental needs. A portion of this water will likely be made available for environmental needs in the future, and may influence flow and water quality conditions in the Delta.

- **Other Projects** – Various other projects and programs are expected to be implemented in the future, including CVP Contract Renewals and further implementation of CVPIA (b)(2) water accounting.

- **Local Actions –** Various local projects may be implemented that affect the primary study area. Zone 7 is pursuing construction of the Altamont WTP to reduce its reliance on groundwater. Due to the accelerated implementation schedule and inclusion of the project in the 2004 Capital Improvement Plan, it is highly likely that this project will be implemented in the future. In addition, CCWD has begun studying an alternate intake location in the central Delta; however, because environmental documentation is not yet available, it is uncertain whether this project will be completed in the near future and, if so, in what form.

FUTURE WITHOUT-PROJECT CONDITIONS

This section summarizes conditions that are expected to occur in the future in the study area. These conditions are described in terms of water resources, physical environment, biological environment, social and economic environment, and cultural environment.

Water Resources

This section discusses the expected future reliability and quality of water resources in the primary study area.

Water Supply Reliability

Anticipated increases in population growth in California will result in increased demands on water resource systems for additional and reliable water supplies. These increasing demands on California's finite water resources are likely to affect all water users, either directly or indirectly. **Table III-17** summarizes Bulletin 160-98 estimated water demands (applied water), supplies, and potential shortages for 2020 levels of demand in the State of California. As shown in the table, estimated future shortages of water supplies in drought years are expected to equal about 6 MAF for the State. It should be noted that an update of the Water Plan is currently underway and, when finalized, relevant information on future water supplies and demands will be considered for the LVE.

Central Valley Project and State Water Project

For the purpose of this analysis, two different water supply scenarios were analyzed for the without-project condition. In one scenario, CVP and SWP supplies are assumed to remain constant, meaning future supplies would be the same as those values shown in **Tables III-7** and **III-10**. In the second scenario, future CVP and SWP values, as simulated in the OCAP study, were implemented (see **Table III-19**, Notes 5 and 6, for adjusted percent allocations). It also is assumed that demands will be fully developed in the future. As contractors request their full entitlements in pace with growing demands, agricultural users would see the greatest cutbacks in deliveries, followed by M&I users. The geographic distribution of project supplies, primarily in the north, is likely to put additional pressure on CVP and SWP Delta conveyance and pumping facilities, even with increased pumping at Banks Pumping Plant. Pumping capacity available for non-project transfers may diminish in the future.

TABLE III-17
ESTIMATED STATEWIDE WATER DEMANDS, SUPPLIES, AND SHORTAGES FOR 2020

Item	State of California (2020)	
	Average Year	Drought Year
Population (millions)	45.6	
Urban Water Use Rate (GPCPD)	235	242
Acres In Production (millions)	9.2	
Agricultural Water Use (AFPA)	3.4	3.5
Applied Water (MAF)		
Urban	12.0	12.4
Agricultural	31.5	32.3
Environmental	37.0	21.3
Total	**80.5**	**66.0**
Water Supply (MAF)		
Surface Water	65.0	43.3
Groundwater	12.7	16.0
Recycled/Desalinated	0.4	0.4
Total	**78.1**	**59.8**
SHORTAGE (MAF)	**2.4**	**6.2**

KEY: GPCPD = gallons per capita per day AFPA = acre-feet per acre
MAF = million acre-feet

Source: The California Water Plan, Bulletin 160-98, Appendix 6A, Regional Water Budgets with Existing Facilities and Programs, November 1998.

Local Agencies

The following summarizes published Bay Area water agency plans to meet future water demands in the primary study area.

Contra Costa Water District – Following its 2000 UWMP, CWD has renewed its CVP contract, implemented an expanded conservation program, secured one 8,000 AFY long-term transfer, and developed over 9,000 AFY recycled water in its service area. CCWD is continuing to examine additional water transfers to meet future needs.

Santa Clara Valley Water District – SCVWD's 2001 UWMP indicates that development of non-structural water supplies through long-term water transfers, increased development of its water recycling program, and further water conservation requirements will be implemented to meet water supply needs in the next 20 years.

Alameda County Water District – ACWD's 2001-2005 UWMP outlines its proposal for water supply management to meet customer water demands through 2020. The plan includes increased desalination and recycled water supplies, water conservation, groundwater management, and off-site banking and transfer opportunities.

Zone 7 – Zone 7's 2000 UWMP outlines multiple programs the Agency plans to pursue to increase its water supply reliability and ensure that Zone 7 meets 100 percent of estimated future demands 100 percent of the time. These plans include imported water, recycled water, demand reduction (conservation), increased conjunctive use of the groundwater basin, and additional out-of-valley storage (Semitropic GBEP). Zone 7 also has begun negotiation of a long-term (through 2035) in-lieu water banking program with Cawelo Water District to increase dry-year supply reliability. As currently envisioned, Zone 7 could store a maximum of 120,000 acre-feet, and Cawelo would provide up to 10,000 AFY on request.

In most cases, no action has been taken to legally secure or develop the supplies outlined above. Many of the agency UWMPs identify additional transfers and long-term contracts to meet future demands. For example, several area water agencies have entered into agreements with the Semitropic GBEP to help meet their dry period needs. In addition, much uncertainty exists regarding the effect of ever-increasing demands on the State's water transfer market, including the ability and cost to acquire water in the future.

Tables III-18 and **III-19** summarize future water supplies and demands under two conditions: if only existing supplies are available in the future, or if both existing and planned local supplies are available in the future, respectively. These supplies and demands are based on data gathered from agency UWMPs and the Bay Area Water Quality and Water Supply Reliability Program's *Water Demand Projections Draft Technical Memorandum*.

Assuming that only those supplies currently available and/or under contract would be available in 2020, the only factor that affects the future 2020 water balance is increased demand. The 2020 water demands are based on each agency's UWMP and information provided by agency staff, excluding CCWD, whose projected water use was obtained from the *CCWD Future Water Supply Study 2002 Update*. Under these conditions, Bay Area water agencies may experience shortages under drought periods, and possibly during average years (as calculated from historical data). Further, Bay Area water agencies currently have aggressive conservation programs; therefore, increased levels of conservation in the future may not provide significant benefits.

TABLE III-18

FUTURE (2020) WATER BALANCE BY YEAR TYPE CONSIDERING EXISTING WATER SUPPLIES

	ACWD[1,2] (TAFY)			CCWD (TAFY)			SCVWD (TAFY)			Zone 7[3] (TAFY)		
Item	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**	**LTA**	**CDP**	**SDY**
Supplies												
CVP	-	-	-	171.6	117.0	105.3	113.0	80.5	71.1	-	-	-
SWP	35.3	17.6	1.3	-	-	-	84.0	42.0	3.0	67.7	33.9	2.4
Local/Other	**42.8**	**57.5**	**52.9**	47.6	23.1	23.1	N/A[4]	N/A[4]	N/A[4]	24.8	40.0	76.5
TOTAL	**78.1**	**75.1**	**54.2**	**219.2**	**140.1**	**128.4**	**N/A**	**N/A**	**N/A**	**92.5**	**73.9**	**78.9**
Demand[5]	77.5	73.5[6]	73.5[6]	207.1	207.1	207.1	488.1	488.1	488.1	83.1[7]	83.1[7]	83.1[7]
Conservation[8]	0.8	0.8	0.8	1.1	1.1	1.1	37.0	37.0	37.0	4.2	4.2	4.2
WATER BALANCE[9]	**1.4**	**2.4**	**-18.5**	**13.2**	**-65.9**	**-77.6**	**N/A[10]**	**N/A[10]**	**N/A[10]**	**13.6**	**-5.0**	**0**

KEY:
ACWD = Alameda County Water District
CCWD = Contra Costa Water District
CDP = critical dry period (CVP/SWP: 1929-1934, Local: 1987-1992)
LTA = long-term average (1922 through early 1990s)
N/A = not available
SCVWD = Santa Clara Valley Water District
SDY = single dry year (1977)
TAFY = thousand acre-feet per year
Zone 7 = Alameda County Flood Control and Water Conservation District, Zone 7

Notes:

Source: District Urban Water Management Plans, unless otherwise noted.

1. *ACWD demands include Distribution system demands and groundwater system demands, (consisting of private groundwater pumping, aquifer reclamation pumping and groundwater outflows to prevent seawater intrusion). Under critically dry conditions, ACWD's groundwater system demands are assumed to be reduced by 4,000 AF/yr which would occur as a result of temporarily lowering groundwater levels. This temporary drawdown may subsequently reduce the quantity of groundwater outflows to the San Francisco Bay, thereby reducing the overall groundwater system demands.*
2. *ACWD supplies and demands are subject to change pending completion of ACWD's 2005 UWMP.*
3. *Changes in local supplies represent an increase in groundwater supply to meet increased demand.*
4. *Groundwater use, a significant part of SCVWD's local supplies, is currently under evaluation and can not be quantified at this time.*
5. *If a range of demands was presented in a district's urban water management plan, the "middle" scenario was used (applies to ACWD and SCVWD).*
6. *Demands during dry periods reflect partial reduction in saline outflows to San Francisco Bay resulting from naturally low groundwater elevations.*
7. *Zone 7 recently revised its demand projections to account for changes in land use zoning. For this reason, these projects may not match those published in Zone 7's UWMP.*
8. *Five percent conservation was assumed for Zone 7.*
9. *A negative water balance represents a shortage.*
10. *The future water balance for SCVWD can not be quantified at this time. See also Note 4.*

TABLE III-19
FUTURE (2020) WATER BALANCE BY YEAR TYPE INCLUDING PLANNED WATER SUPPLIES

Item	ACWD[1] (TAFY)			CCWD[2] (TAFY)			SCVWD[3] (TAFY)			Zone 7[4] (TAFY)		
	LTA	CDP	SDY	LTA	CDP	SDY	LTA	CDP	SDY	LTA	CDP	SDY
Supplies												
CVP[5]	-	-	-	169.7	115.1	109.2	125.5	79.0	74.2	-	-	-
SWP[6]	34.9	17.6	1.7	-	-	-	83.0	42.0	4.0	66.9	33.9	3.2
Local Supplies	50.2	65.3	62.5	80.7	42.7	28.5	N/A	N/A	N/A	25.2	40.9	71.6
TOTAL	**85.1**	**82.9**	**64.2**	**250.4**	**157.8**	**137.7**	**N/A**	**N/A**	**N/A**	**92.1**	**74.8**	**74.8**
Demand[7]	77.5	73.5[7]	73.5[7]	207.1	207.1	207.1	488.1	488.1	488.1	83.1[8]	83.1[8]	83.1[8]
Conservation[9]	2.9	2.9	2.9	6.4	6.4	6.4	52.7	52.7	52.7	8.3	8.3	8.3
WATER BALANCE[10]	**10.5**	**12.3**	**-6.4[12]**	**49.7**	**-42.9**	**-63.0**	**N/A[11]**	**N/A[11]**	**N/A[11]**	**17.3**	**0**	**0**

KEY: ACWD = Alameda County Water District
CCWD = Contra Costa Water District
CDP = critical dry period (CVP/SWP: 1929-1934, Local: 1987-1992)
LTA = long-term average (1922 through early 1990s)
N/A = not available
SCVWD = Santa Clara Valley Water District
SDY = single dry year (1977)
TAFY = thousand acre-feet per year
Zone 7 = Alameda County Flood Control and Water Conservation District, Zone 7

Notes:

1. *ACWD planned local supplies include water recycling and added desalination (2001-2005 Urban Water Management Plan (UWMP)), and slightly improved SFPUC water supply availability. All supply and demand figures are subject to change pending completion of ACWD's 2005 UWMP.*
2. *CCWD planned local supplies include projected East Contra Costa irrigation District transfers, proposed water recycling projects, and an additional 30,000 acre-feet annually in water transfers.*
3. *SCVWD planned local supplies include full use of Semitropic GBEP and planned water recycling projects. Groundwater use can not be quantified at this time.*
4. *Changes in Zone 7 local supplies: LTA - increase in Del Valle storage capacity (2020 sustainable supply) and a decrease in groundwater recharge, CDP & SDY - decrease in groundwater supply to account for increased conservation.*
5. *Federal contract allocations north-of-Delta vary by water use and hydrologic year type (OCAP_2020D09D_FutureEWA values):*
   <u>Municipal and Industrial (M&I)</u> – LTA: 1922-1994 (87%), CDP: 1929-1934 (59%), SDY: 1977 (56%)
   Federal contract allocations south-of-Delta vary by water use and hydrologic year type (OCAP_2020D09D_FutureEWA values):
   <u>M&I</u> – LTA: 1922-1994 (86%), CDP: 1929-1934 (59%), SDY: 1977 (56%)
   <u>Agriculture</u> – LTA: 1922-1994 (61%), CDP: 1929-1934 (10%), SDY: 1977 (6%)

Notes continued on following page.

Table III-19 Notes, continued.

6. *State contract M&I allocations vary by hydrologic year type (OCAP_2020D09D_FutureEWA values): LTA (83%), CDP: 1929-1934 (42%), SDY: 1977 (4%)*
7. *If a range of demands was presented in a District's UWMP, the "Middle" Scenario was used (applies to ACWD and SCVWD demands). ACWD demands include Distribution system demands and groundwater system demands, (consisting of private groundwater pumping, aquifer reclamation pumping and groundwater outflows to prevent seawater intrusion). Under critically dry conditions, ACWD's groundwater system demands are assumed to be reduced by 4,000 AF/yr which would occur as a result of temporarily lowering groundwater levels. This temporary drawdown may subsequently reduce the quantity of groundwater outflows to the San Francisco Bay, thereby reducing the overall groundwater system demands.*
8. *Zone 7 recently revised its demand projections to account for changes in land use zoning. For this reason, these projects may not match those published in Zone 7's UWMP.*
9. *Ten percent conservation was assumed for Zone 7.*
10. *A negative water balance represents a shortage.*
11. *The future water balance for SCVWD can not be quantified at this time.*
12. *This shortage is within ACWD's accepted water supply reliability goal to sustain a shortage of no more than 10% during dry and critically dry conditions as outlined in ACWD's Integrated Resource Plan and UWMP. ACWD plans to mitigate this level of shortage through voluntary and, if necessary, mandatory conservation measures.*

Source: District Urban Water Management Plans, unless otherwise noted (see also notes for Table III-10).

If planned water supplies within the study area (supplies identified in UWMPs but not yet secured or developed, including planned future conservation) and future CVP and SWP deliveries as per the OCAP study also are included, the water balance would be as shown in **Table III-19**. This table indicates that the region would experience water shortages even if planned supplies outlined in agency UWMPs are secured.

Water Quality

Water quality in the Delta is expected to remain generally as under existing conditions, with seasonal and drought related declines. Historically, water quality tends to be poorest in the fall and during dry years; these trends are not likely to reverse in the future. Various programs are in place to prevent further deterioration of Delta water quality. Implementation of projects that would increase Delta exports, such as the SDIP, would include measures to mitigate for any water quality impacts. Saline intrusion into local aquifers is expected to remain as under existing conditions as local groundwater supplies are increasingly relied on, but recycling and recharge programs are likely to slow the progression. In the future, it is likely that local water agencies will not achieve their overall water quality objectives as frequently as under existing conditions. As local substitute supplies to Delta exports are relied on more heavily and become less available, and rising demands for water in the Central Valley exert pressure on the Delta, it will become more difficult and costly for Bay Area water agencies to provide high-quality water in the future.

In addition to regulatory environments that increase the demands on water supplies, a growing institutional regime to facilitate exchanges and operational flexibility will place additional demands on water supplies and conveyance systems. Institutions include the Sacramento Valley Water Management Program, SDIP, Coordinated Operation Agreement (COA), JPOD, the DWR Dry Year Program, Drought Risk Reduction Investment Program, and EWA.

Delta Fishery Resources

Planned increases in pumping rates at major Delta export facilities are likely to increase the population effects on threatened and endangered fisheries. Regarding delta smelt specifically, increased water demands both inside and outside the Delta are likely to result in less favorable rearing conditions in Suisun Marsh, increased vulnerability to entrainment, and less water available for maintaining the X2 position (USFWS *5-year Review* of delta smelt recovery status, March 2004). These impacts would be offset to some degree by pumping restrictions and other protective actions. BOs and other regulatory actions of Federal and State wildlife agencies with regard to special-status species are expected to remain as under existing conditions.

Efforts are underway to implement programs and projects to help protect and restore threatened fisheries resources in the Delta. For example, as described previously and in **Chapter II**, the EWA provides an institutional structure through which water can be predelivered to Delta-export storage areas prior to pumping curtailment, or post-delivered from Delta-import storage following a pumping curtailment. Key factors that may influence whether EWA water acquisition targets are met in the future include water procurement and conveyance costs, transfer market liquidity, dedicated pumping and conveyance capacity in the south Delta, storage reliability, Federal and State funding, and hydrologic conditions.

To date, the EWA has obtained water from surplus Delta flows, source shifting, and short-term borrowing arrangements, but has primarily relied on single-year, transfer market water acquisitions to meet its water supply and fishery action objectives. Under this mode of operation, the effectiveness of the EWA is primarily governed by two factors: its ability to acquire sufficient water, and the availability of surplus pumping capacity at CVP and SWP export facilities needed to bank the water in south-of-Delta export service areas. EWA implementing agencies have developed estimates of water acquisition for a long-term EWA. Typically, the EWA program purchases 200,000 to 300,000 acre-feet of water annually.

While water is abundant in wet years, conveyance capacity is lacking, making it more difficult for the EWA to move supplies through the Delta and take advantage of surplus conditions. While the delivery impacts of pumping curtailment are less for contracted water, other transfers have conveyance priority over EWA water acquisitions. Additionally, the scarcity of supplies available on the transfer market in the future will increase the cost of these supplies as contractors compete with the regulated allocation of water to environmental purposes. In summary, it is likely that future implementation of the long-term EWA will be limited by reduced pumping capacity at south Delta export facilities and changes in the cost and availability of water on the transfer market.

Further, the EWA does not have a firm, fixed storage asset where it can store water or carry water over to the following year. While EWA uses San Luis, Oroville, Folsom, and Shasta reservoirs, a risk always exists of losing water if the reservoir needs to spill for flood control or other reasons. Also, as pumping exports south of the Delta increase to meet demands, the CVP and SWP are likely to store more water in San Luis Reservoir. Because EWA space in San Luis is secondary to CVP and SWP storage allocations, EWA water would be more likely to spill under these conditions.

Physical Environment

Basic physical conditions in the study area are expected to remain relatively unchanged in the future. No major changes to area topography, geology, or soils are foreseen. From a geomorphic perspective, ongoing restoration efforts in the Delta and its upstream tributaries are expected to marginally improve natural processes in the Delta. Without major physical changes to the river systems or significant increases in south Delta pumping, overall hydrologic and hydrodynamic conditions in the Delta will probably remain unchanged. Some speculation exists that the region's hydrology could be altered should there be significant changes in global climatic conditions. Scientific work in this field of study is continuing.

Much effort has been expended to control the levels and types of herbicides, fungicides, and pesticides that can be used in the environment. Further, efforts are underway to better manage the quality of runoff from urban environments to major stream systems. However, water quality conditions are expected to generally remain unchanged and similar to existing conditions. Most of the air pollutants in the study area will continue to be influenced by both urban and agricultural land uses. As population continues to grow, and remaining open space and agricultural lands are converted to urban centers, a general degradation of air quality conditions could occur.

As urban water demands increase, additional agricultural lands are likely to be fallowed in the Central Valley and the Delta. Land use in the Bay Area is expected to remain as under existing conditions, but current agricultural-to-urban land conversion trends in the Central Valley and around existing Delta communities will likely continue.

Biological Environment

Significant efforts are underway by numerous agencies and groups to restore various biological conditions in the Delta and throughout the study area. These include elements of the CALFED programs, continued habitat conservation actions by CDFG and other State agencies, efforts by local recreation agencies and private conservation groups, and numerous other programs and projects. Accordingly, additional areas of wildlife habitat, including wetlands, grasslands, and riparian areas, are expected to be protected or restored. However, as population and urban growth continues, many wildlife species also are likely to be impacted.

Social and Economic Environment

The population of the State is estimated to increase from about 35 million in 2000 to about 46 million by 2020, and to over 55 million by 2050 (*Census 2000*). To support these expected increases in population, some conversion of agricultural and other rural land to urban uses is anticipated, particularly in the Central Valley. Modification of existing traffic corridors and construction of new transportation routes likely will occur, further connecting the Bay Area to anticipated population growth centers in the Central Valley.

The increase in population during this time will be accompanied by an increase in the economic output of the State, which is likely to at least double (based on the State's historical economic performance with respect to output and corporate taxes). However, shortages in key inputs, including water resources, could limit economic output, and have potentially other serious effects throughout the economy and population.

Anticipated increases in population growth also will have impacts on visual resources within the Central Valley and primary study area, as areas of open space are converted to urban uses. These increases also will result in increased demands for electric, natural gas, water, and wastewater utilities; public services such as fire, police protection, and emergency services; water-related infrastructure; and communication infrastructure. Further, the increasing population will increase the potential for hazardous toxic radiologic waste issues in the future. In addition, the increasing population will place pressures on preservation of existing historic and prehistoric cultural sites within the study area

The increase in population and aging "baby boomer" generation will increase the need for health services. During the 2000 to 2010 decade, many workers will reach 60 years and older. The general migration of retirees and older Americans from colder northeastern regions to warmer southern regions is expected to continue. Many of the region's high school graduates will remain in the Bay Area or move to Southern California to attend college and find employment. However, housing opportunities and a lower cost of living are likely to continue to attract Bay Area residents to adjacent Delta and Central Valley communities.

Cultural Environment

Any paleontological, historic, archaeological, or ethnographic resources currently being affected by agricultural practices or other ongoing activities in the study area would continue to be impacted.